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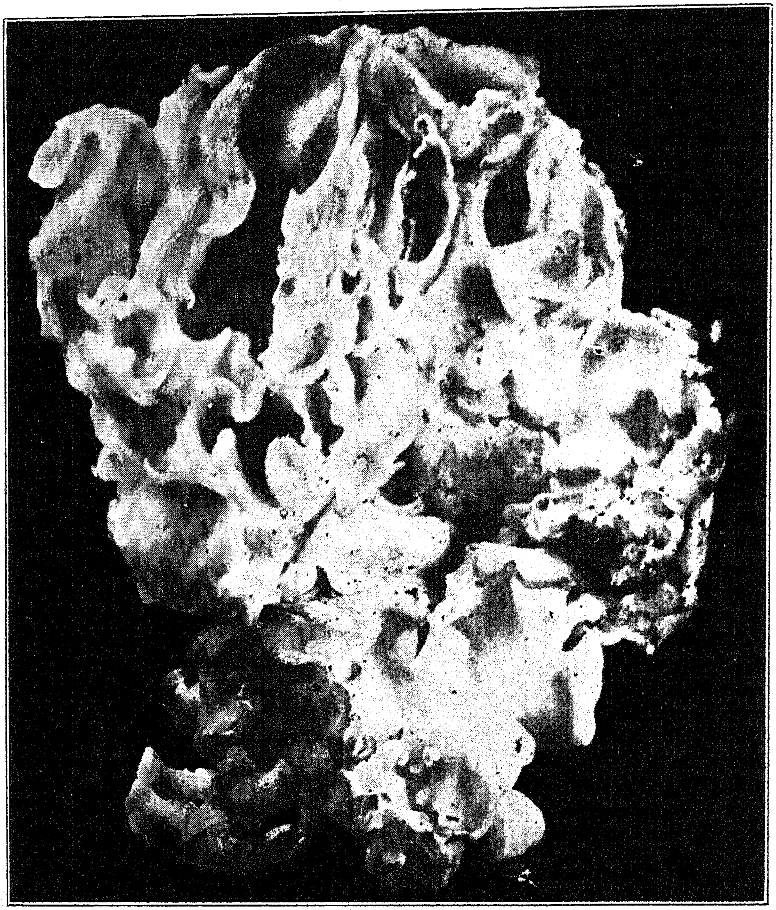

PEZIZA PROTEANA SPARASSOIDES BOUD.

MYCOLOGIA

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PEZIZA PROTEANA VAR. SPARASSOIDES IN AMERICA

ELIAS J. DURAND

(WITH PLATE 1)

Peziza proteana was described by Boudier,[1] in 1899, from material collected in the forêt de Carnelle, near Paris. In 1917, Seaver[2] published a photograph and description of the species, stating that it had appeared several times in the vicinity of New York City, and citing Texas, also, as within its range of distribution. Two collections of *P. proteana* were made at Ithaca, N. Y., by E. J. Petry, in 1907 and 1909, both of which were studied in the fresh condition by the writer. The plants were growing in late autumn, on burnt soil around the bases of trees, on the wooded, swampy flats at the head of Cayuga Lake. The collection made in 1907 (Herb. Durand, no. 5251) consisted of three separate ascomata, about 5 cm. in diameter, bowl-shaped and somewhat inequilateral, and of one group made up of several cups coalesced into a large, irregular *Gyromitra*-like mass. The specimens were all growing together, and microscopical examination disclosed no differences in either excipular structure or hymenial characters. The compound mass gave every appearance of being an extreme development of the condition seen so often among the fleshy Pezizas when growing closely crowded together. In *P. badia* and *P. vesiculosa*, for example, the writer has seen large numbers of crowded ascomata not only cohering closely, but the tissues of adjoining cups so completely grown

[1] Bull. Soc. Myc. Fr. 15: 50. *pl. 3. f. 1.* 1899.

[2] Mycologia, 9: 1–3. *pl. 1.* 1917.

[MYCOLOGIA for November (10: 277–307) was issued November 23, 1918.]

together that they could not be separated, and it was difficult to make out in sections where one ended and the other began. In Petry's 1909 collection (Herb. Durand, no. 6932) the numerous cups were densely cespitose and more or less coherent.

On October 27, 1909, Professor G. F. Atkinson collected beautiful specimens of the compound form, on burnt soil about the bases of dead elm trees, on the same Cayuga Flats. The masses were much larger, more intricate, and in every way more highly developed and complex than the one gathered by Petry. A very noticeable feature was the extreme brittleness of the flesh, the masses falling to pieces almost at a touch. These specimens were examined by the writer and found to agree excellently with Boudier's description and figures of *Galactinia proteana* var. *sparassoides* Boud.[3] Professor Atkinson has recently very kindly placed in my hands notes and photographs made by him from the fresh plants, with the suggestion that they be published. His notes are as follows:

"Plants sessile without any stem above or in the ground. One plant 25 cm. broad, rather old and somewhat collapsed, probably about 15 cm. high. Fresh plants smaller, more or less oval or elliptical in general outline, 10–12 cm. high by 7–9 cm. broad. At first lilac in color and the younger parts lilac, older parts becoming whitish to creamy white, very fleshy, entirely made up of convoluted branches and anastomosing, lamellar structure. The large cells or caverns .5–2 cm. in diameter, irregular, extending from the base through all parts of the plants, thus sometimes having a more or less radiate structure. Hymenium on both surfaces of the walls. The soil at the base is sometimes quite rich in mycelium. As this comes to the surface the fruit body begins to develop, forming an irregular, expanded, and folded structure which is whitish or lilac in color, bearing the hymenium. The extension of these folds and caverns produces the large fruit body. Asci cylindrical, 200–226 × 10–12 μ. Spores uniseriate in the upper third of the ascus, elliptical, roughened, hyaline, biguttulate, 10–12 × 5–6 μ."

It should be added that the asci become intensely blue with iodine, and the excipulum consists of two layers of large, vesiculose cells, 30–60 μ in diameter, separated by a median layer of stout hyphae.

[3] Bull. Soc. Myc. Fr. **15**: 51. *pl.* 3. *f.* 2. 1899.

In his most recent work Boudier speaks of this plant, as follows:[4] "This curious production, which I can regard only as a luxuriant state of *Galactinia proteana* has all its anatomical characters save the margin and external form; it is to my mind an hypertrophied state of this species, excessively analogous to that which one finds in *Disciotis venosa, reticulata* and *Aleuria vesiculosa* var. *saccata*. It is remarkable for its fragility and appears more frequently than the type."

In this connection reference should be made to a plant collected by Polley, at Belton, Lake McDonald, Mont., in 1903, and described by Miss Hone[5] under the name *Gyromitra Phillipsii* Mass. Miss Hone's notes indicate a plant very similar to *P. proteana* var. *sparassoides,* and examination of alcoholic material kindly sent to the writer by Miss Hone proves that it is identical with the one collected at Ithaca.

One is thus led immediately to inquire whether Boudier's *G. proteana* var. *sparassoides* may not be the same as Massee's *Gyromitra Phillipsii*. A careful study of Phillips's description and figures[6] of the plant which he regarded as the true *Gyromitra gigas* Kromb., and of Massee's description[7] has convinced the writer that the two plants are identical without question. However, only a study of authentic specimens, which are not available to the writer, can settle the matter definitely.

DEPARTMENT OF BOTANY,
UNIVERSITY OF MINNESOTA,
MINNEAPOLIS, MINNESOTA.

[4] Icon. Myc. 4: 162. 1911.
[5] Postelsia, 1906: 237–244. 1906.
[6] Journ. Bot. 31: 129. *pl. 334.* 1893.
[7] Brit. Fung.-Flora 4: 478. 1895.

NEW OR NOTEWORTHY PORTO RICAN FUNGI

F. L. Stevens and Nora E. Dalbey

(With Plates 2 and 3)

The following forms were collected by the senior author in Porto Rico. Specimens are deposited as stated in an article by Esther Young.[1]

Septoriopsis gen. nov.

Spores long-filamentous; conidiophores simple, borne on a tubercular base. Distinguished from related genera as is indicated in the adjacent key.

Type species, *Septoriopsis Chamaesyceae.*

Septoriopsis Chamaesyceae sp. nov.

Figs. 1, 2

Spots circular, definite, small, 1–4 mm. in diameter; centers pale to ashen; borders red. Sporodochia amphigenous, top-shaped, arising deep within the leaf tissue and erumpent, dark, about 45 μ broad at the top and of slightly greater height from base to top. Conidia like those of *Septoria,* about 35 μ long, 2 μ thick.

On *Chamaesyce hypericifolia,* Trujillo, *9438,* Rio Piedras, *9445* (type).

The Tuberculariaceae-Scolecosporiae in the first eighteen volumes of Saccardo's "Sylloge Fungorum" contain only the genus *Schizotrichum,* while volume 22 adds *Ranojevicia, Linodochium,* and *Volutellopsis.* The essential characters separating these genera are shown in the following key:

Sporodochium setose.	Schizotrichum.
Sporodochium with a ciliate margin.	Volutellopsis.
Sporodochium not setose or ciliate-margined.	
Conidiophores dichotomous.	Ranojevicia.
Conidiophores verticillate.	Linodochium.
Conidiophores simple.	Septoriopsis.

[1] Mycologia 7: 143. 1915.

Septoriopsis Piperis sp. nov.

Figs. 3, 4

Spots irregular, definitely limited, 1–2 cm. in diameter, infected tissue dead, dirty-white, bordered by a thin purplish-brown line, closely set with spore clusters. Mycelium internal, fine; conidiophores in clusters of large numbers, of same diameter as spores, aggregated into a sporodochium 45–60 μ in diameter, about 90 μ high. Conidia long, narrow, 68–165 $\times$ 3–4 μ, many-septate, obtuse, pale.

On *Piper medium,* San German, *5792* (type).

This fungus is especially interesting, since it is close to both the Melanconiales and the Moniliales. The conidiophore clusters are so large, dense, and short that the group on mere superficial examination might readily be regarded as an acervulus or even as a pycnidium but might equally be regarded as a group of conidial hyphae. The true relation is clearly shown only by microtome section. The young tubercles are often solid, nearly spherical masses which develop subepidermally and later become erumpent. When of this form they superficially and even in section look much like *Septoria.*

EXOSPORIUM Link

Exosporium Leucaenae sp. nov.

Figs. 5, 6, 7

Spots 2–4 mm. in diameter, circular, tawny, rather closely covered by sporodochia. Sporodochia hypophyllous, 110–240 μ in diameter, 30–40 μ high, exclusive of the spores, almost or quite flat-topped. Conidiophores barely tawny, much lighter in color than the spores, simple or branched toward the tip, thick, obtuse. Conidia clavate, brown, three or more septate, 58 $\times$ 8 μ obtuse, often tapering to one end.

On *Leucaena glauca,* Arecibo, *6792* (type), Vega Baja, *4295,* Manati, *5265,* Quebradillas, *5122,* Aguada, *5076.* The fungus would fall in the genus *Helminthosporium* but for the sporodochial character. The condiophores are, however, closely compacted into a true tubercular structure which, except for height, might be regarded as a coremium. To the naked eye the sporodochia look much like the sori of a rust.

RAMULARIA Unger

Ramularia Mimosae sp. nov.

Fig. 8

Conidiophores amphigenous, more abundant above. Spots indefinite, the whole affected leaf portion covered with a conspicuous whitish coating of the conidia and conidiophores. Condiophores in clusters of from ten to thirty + from the stomata, hyaline, short, about $17 \times 4 \mu$, unbranched, continuous. Conidia hyaline, $24–37 \times 3.5 \mu$, several-septate, straight or crooked, tapering to each end, obtuse.

On *Mimosa pudica,* Coamo Springs, *8367* (type), Penuelas, *7215,* Arecibo-Lares road, *7298,* Mayaguez, *7110,* Lajas, *7158.* This fungus is very common in Porto Rico and to the naked eye has all the appearance of an Oidium. It is quite distinct from *Cercosporella Mimosae* Sacc.

HAPLOGRAPHIUM B. & Br.

Haplographium portoricense sp. nov.

Fig. 9

Fungus superficial, forming diffuse, sooty spots on the leaf surface, epiphyllous or hypophyllous. Mycelium fine, $1.5 — 1.7 \mu$, pale-yellow, forming a loose network over the leaf. Conidiphores arising directly from the mycelium, black, usually in small, 3–10, clusters, about 170μ high, 7μ thick, straight, rigid, septate, pale at tip, sometimes with few lateral branches. Apex branching as in *Penicillium.* Conidia ovoid, continuous, dark-colored, $17–20 \times 7–10 \mu$.

On *Canna,* El Gigante, *8495* (type), *Canna coccinea,* Aibonite, *8447.*

The fungus appears to be strictly superficial and in general appearance is a sooty mold. The myceliūm where it aggregates and gives rise to a cluster of conidiophores is much darker than the ordinary vegetative mycelium but is no greater in diameter. The conidiophores, however, are much thicker, about three times as thick as the mycelium.

The description is drawn from epiphyllous material. When hypophyllous, marked variations occur, such that were the speci-

mens examined independently they might not be placed in even the same genus. Here the typical *Penicillium*-like branching is rare, the conidiophores are longer (340 μ) and more attenuate, more lax, and typically show lateral sporiferous branches.

MICROCLAVA Stev.

Microclava Coccolobiae sp. nov.

Fig. 10

Mycelium internal, pale to brown. Conidiophores simple, about 70 μ high, 3 μ thick at base; stipe usually unicellular, upper part broadening gradually to 8 μ in thickness, and consisting of three superimposed cells.

On *Coccoloba diversifolia,* Maricoa, *8877* (type).

Wageria gen. nov.

Mycelium dark, superficial, with hyphopodia. Perithecium spherical, not ostiolate. Both typically perisporiaceous. Asci 8-spored. Spores dark, 2-celled. Perithecium with one or few vermiform appendages.

Type species, *W. portoricensis.*

The genus is named in honor of Dr. Harold Wager, of England. It differs from *Dimerium* Sacc. and Syd. in the possession of the vermiform appendage. It differs from *Phaeodimeriella* Th. and *Acanthostigma* in the absence of true setae.

Wageria portoricensis sp. nov.

Figs. 11, 12

Mycelium pale-brown, superficial, branching irregularly, 4 μ thick. Hyphopodia numerous, averaging about 35 μ apart, irregularly located, not opposite, nor regularly alternate, when young nearly spherical, soon becoming quite irregular in outline, usual diameter about 7 μ, occasionally exceeding 10 μ, usually with a central clear spot probably indicating attachment. Perithecia spherical, non-ostiolate, small, 47–55 μ in diameter, with few asci which mature successively, not simultaneously. Perithecia with 1–3, usually 1, coiled, vermiform appendages, dark, 40–80 × 7 μ. Asci irregular in shape, 8-spored, inordinate. Spores 2-celled, obtuse, dark, 21 × 6–7 μ.

On *Gonzalagunia spicata.* Jajome Alto, *8407* (type), El Alto de la Banderas, *7636*.

The characteristic appendages remind one strongly of the so-called chitinous appendages on certain Meliolas, *e. g., M. puiggarii.* They differ decidedly from true setae. In most cases there is only one on a perithecium, rarely so many as three. The perithecial wall is translucent and through it may be recognized the asci and even the spores and their septation. There is only one mature ascus but by crushing the perithecium the presence of other asci in earlier stages of development may be shown.

Mycosphaerella subastoma sp. nov.

Figs. 13, 14, 15

Spots brown, long, narrow when young, 1–2 mm. wide, 3–4 mm. long, limited laterally by veins; later by coalescence and spreading involving whole leaf segments. Perithecia 125 μ in diameter, solitary or grouped in large clusters of 2–40, dark-brown to black, globose, subepidermal, with a short beak reaching into the stomata; ostiole subastomal, definite, 20–30 μ in diameter. Asci 8-spored, $47 \times 20\,\mu$, apex strongly thickened. Spores long, narrow, $22–24 \times 4\,\mu$, hyaline.

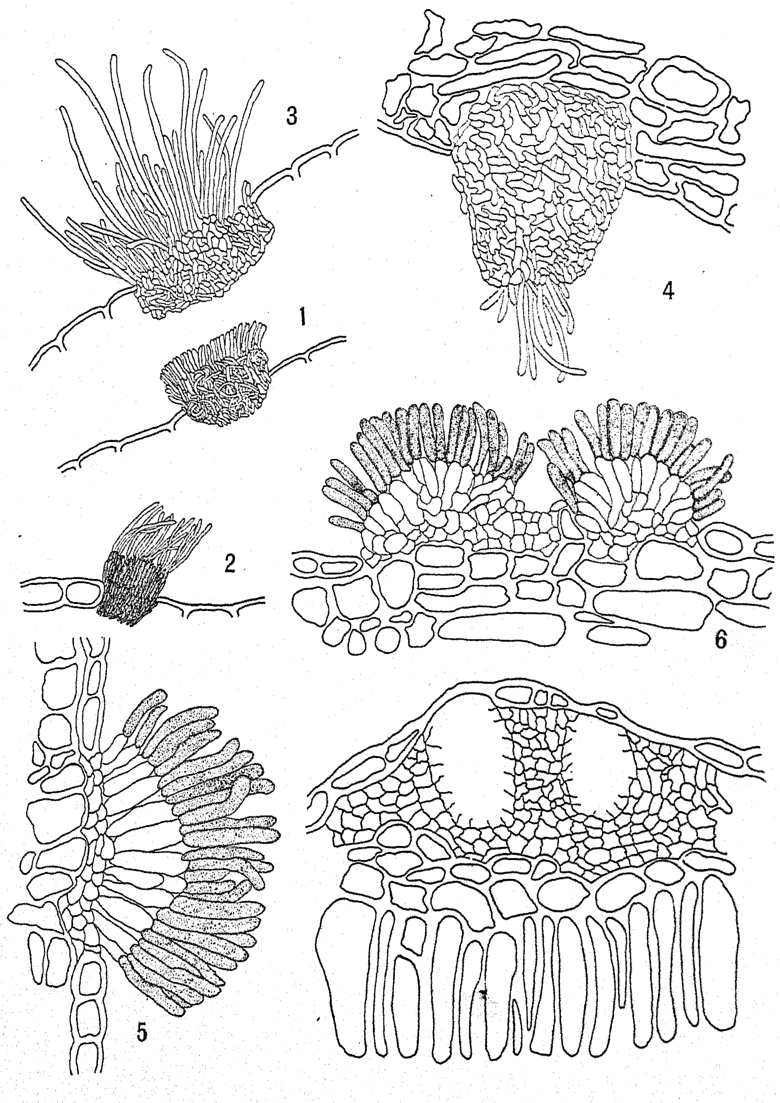
On *Aneimia adiantifolia.* Dos. Bocas., *8058* (type).

The three striking characters of this species are: the location of the ostioles directly under the stomata, the grouping of the perithecia, and the limitation of the fungus by the veins. The fungus develops strictly subepidermally and even at maturity does not become erumpent, liberating the spores by way of the stomata. The fungus differs markedly in essential characters from the several species previously described on ferns.

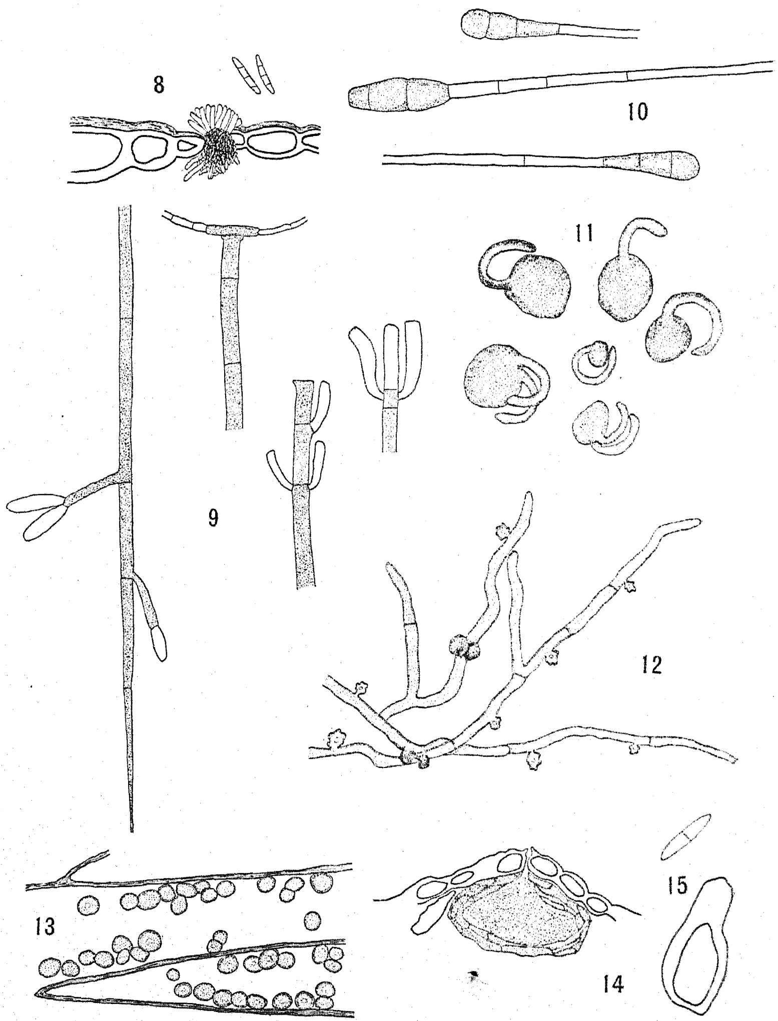
MYCOSPHAERELLA TYROLENSIS (Auer.) Lind.

Sphaerella tyrolensis Auer. on *Gymnogramme calomelanos*
Barros, 140

Very numerous, small, 1–3 mm., tan-colored spots are produced on the host and these spots are thickly studded with the minute perithecia. Numerous "Sphaerellas" are recorded on the Pteridophytes, but all disagree with the specimens under dis-



PORTO RICAN FUNGI



PORTO RICAN FUNGI

cussion as to spore size and shape except the one above named. With this one, agreement is quite satisfactory with exception of perithecium size, which in the Porto Rican material is very uniform and considerably below the dimensions given for *M. tyrolensis*.

STEPHANOMA Wallr.

Stephanoma Melioliae sp. nov.

Mycelium hyaline, fine, 0.5–1 μ, crooked, abundant, overgrowing the *Meliola* and the adjacent leaf surface with a close network. Conidiophores arising directly from the mycelium, solitary or in groups, simple, erect, 17–27 $\times$ 3 μ, often curved at the tip. Conidia of two types: (1) spherical, 5 μ in diameter, hyaline, 1-celled, with usually eight straight, stiff spines about 3–4 μ long; (2) small, oblong, 6 $\times$ 3 μ, obtuse, continuous, hyaline.

On *Meliola tortuosa* Wint. on *Piper umbellatum* Lares, *4843* (type).

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EXPLANATION OF PLATES

PLATE 2

Figs. 1, 2. *Septoriopsis Chamaesyceae, 9445* (type). Sporodochia.

Figs. 3, 4. *Septoriopsis Piperis, 5792* (type). Sporodochia and spores.

Figs. 5, 6. *Exosporium Leucaenae, 6792* (type). Sporodochia and spores.

Fig. 7. *Exosporium Leucaenae* showing subepidermal development of the sporodochia.

PLATE 3

Fig. 8. *Ramularia Mimosae, 8367* (type). A cluster of conidiophores and conidia.

Fig. 9. *Haplographium portoricense, 8495* (type). (*a*) Condiophores showing the Penicillium-like branching. (*b*) Showing origin of conidiophore from mycelium, the mycelium being very fine and colorless and the conidiophore thick and dark. (*c*) Conidia from colony on the lower side of the leaf showing different form, mode of branching and size.

Fig. 10. *Microclava Coccolobiae, 8877* (type). Conidiophores and conidia.

Fig. 11. *Wageria portoricensis.* Perithecia with coiled, vermiform appendages, *8407* (type).

Fig. 12. *Wageria portoricensis.* Mycelium and hypopodia, *8407* (type).

Fig. 13. *Mycosphaerella subastoma.* Grouping of perithecia and limitation by veins, *8058* (type).

Fig. 14. *Mycosphaerella subastoma.* Showing perithecium is subastomal.

Fig. 15. *Mycosphaerella subastoma.* An ascus and spore.

NOTES ON CALIFORNIA FUNGI

H. E. Parks

The last two seasons, so far as weather conditions are concerned, have been anything but ideal. A long-continued drought was the direct cause of failure to secure many species that ordinarily are very plentiful. Again, the scattered storms have induced growth among some species over a most unusual length of time.

To one who is familiar with climactic conditions it would readily be seen that a long season with the fungi is hardly to be expected. Especially is this true when it is known that the dry season is very long, and never broken by summer showers such as are known in the eastern and northern states. Yet, under these dry conditions, one may be able to find many rare specimens of hypogaeous fungi as well as species of Hymenomycetales.

The active work in this investigation was begun in the fall of 1916, and has been continued steadily ever since, including constant observation of the districts to be worked, throughout the entire dry, dormant summer season. The work itself was planned, so far as possible for one man, to include a thorough search over definite regions, and to collect systematically all species found. Thus it was hoped to establish the complete range of species and also the duration of seasons. Special attention was to be devoted to certain classes, such as the Boletes, to solve the really complex problem of their relationship to eastern and European species; to really find out what species are found in this state.

Again, the Hymenogastrales and Tuberales, especially the latter, were to receive a most thorough investigation.

The results considered in this article were obtained only by persistent work under adverse and trying conditions. The amount of time devoted to exploring has been limited to one day in ten this last season, often after having worked all night, and in the face of winter storms. I have ridden over one thousand

miles on a bicycle, carrying a pack and a small rake. I have been taken for a game poacher and a fish shooter, and in one place was persistently hunted as a spy.

Notes and records are made with all material taken. Copies of the notes accompany the specimens, which are all sent to the Department of Botany at Berkeley, California, and there finally classified and preserved in the herbarium or dispatched to various specialists.

To say the least, the work is both arduous and intensely interesting. One who would engage in such a survey must be prepared to encounter and overcome many difficult situations. It is not all rambling over pretty meadows and fine wood-bordered roads. I have ridden many miles over the finest highways in the world, and also over miles of bad roads, railroad ties, and by-paths.

In the fall of 1916 we were favored with some very early rains that were sufficient to start the early fungi. It was, however, well into November before operations began. This first trip was made into the Santa Cruz Mountains, known to be very rich in Boletes. The trip was taken with the idea of a general survey of the district rather than any considerable amount of collecting. A cold snap set in, and the result was that very little material was visible in condition to be gathered. There was, however, evidence of an amazing variety of Agarics as well as several species of Boletes. A few specimens were taken, but nothing of special interest was noted except the enormous quantities of a large white *Tricholoma*. By way of extreme contrast, this same region, for the fall and winter of 1917–18, has been absolutely barren of this species. In fact, this season, there was not a hundredth part of the fungi seen in the previous year.

However, there was one discovery of considerable interest, and that was the finding of two individuals of an apparently new *Boletinus*. There are no descriptions to fit it, and constant watch is now kept for any recurrent plants. Nowhere else, search as I would, could I discover another specimen. Growing among dry, brown leaves, they are hard to distinguish, as the surface of the pileus is chocolate-colored and very deeply cracked or furrowed, and it measures some five to seven centimeters across.

Beneath, the tubes are very large, angular and dirty white; in fact, they are the largest in width of any species yet seen. The stipe is short, thick and lateral, with tubes decurrent. It is solid, tough and concolorous. When first seen the plant appears to be sessile, and altogether very unique.

Successive weekly trips were made to this location for some time, but no results were obtained until late in the spring after a long, cold winter, broken by one storm of exceptional duration and precipitation.

Late in March I visited the locality for the last time during the season, and within a few feet of the place where the *Boletinus* was taken, I found several specimens of *Gyromytra* which resemble *G. esculenta* very closely, but are apparently distinct. The fall of this year, upon one of my first visits, I was again surprised on the same spot with a single *Boletus* of large dimensions, and distinct from any species ever seen here. It was not in perfect condition, however, the large stipe being nearly severed by larvae.

The pileus was very conspicuous, being a brilliant red color, and covered with a dense jelly several millimeters in thickness. It was circular, broadly expanded, margin thick and even, with thick white flesh that turned slowly to a dirty-blue when broken. This flesh was not infested with larvae, the short yellow tubes but slightly so, and the stipe was almost totally destroyed. Like so many others, this last year, but a single plant was found. It is this search for the rare species that lends zest to the work and pleasure in the constant new discoveries resulting from intensive application to it. There is sport and excitement for the lover of outdoor life.

For some time during the winter of 1916–17, I made frequent trips to a region just about six miles south of San Jose, to what is known as the New Guadaloupe Mines. The topography of the country is interesting from many points of view. That particular portion which I was then interested in, and still have under observation, was a long, low ridge or two, very heavily wooded on the eastern slopes with a second growth of Coast Live Oak, *Quercus agrifolia*. It was the very nature of this growth that invited careful investigation. Many trips were made, and ex-

plorations extended all over this district, but with little results. I became very much discouraged at repeated failures here, as I had hope of securing some Tuberales and Boletes. Going over this ground was exceedingly hard work. I was led to return to this region mainly by noticing the work of the wood rats. And it was by watching the holes dug into hard ground, often a foot deep, that led finally to making some real discoveries.

This locality yielded me some very good specimens for instruction work; especially was this true of the common *Chanterelle.* This especially desirable fungus was absolutely unkown here until I exhibited some specimens from the coast, where it is very abundant. On this side of the mountains it is not very often found, and I hunted several seasons for it, finally securing specimens at Guadaloupe. Several fine species of *Clavaria* were also used for exhibition and instruction, as they were also unknown here.

I spent literally hours upon hands and knees in crawling through thickets and raking over the leafy deposits, and on one occasion I thus turned up a very peculiar specimen of *Thelephora* which was sent to Professor Burt for determination, as no description could be found to fit it. This is an instance where no definite location could be fixed that would be a guide to additional material; growing on the ground, covered with leaves and of itself inconspicuous.

On another day I came upon two specimens of *Amanita* growing close to the bole of a live-oak. They were exceptionally large, and symmetrical in proportion. Tinged with crimson, they seemed to fairly radiate with color. I turned them in as belonging to the *rubescens* group, but from what descriptions were available they seem a new and distinct species. This difference from published descriptions, or the entire lack of such descriptions, has been one of the strong incentives to the work now in hand.

Persistence had its reward, and on a trip to "The Call of the Wild" in the Santa Cruz Mountains I came upon a grove of pines in which a dense mat of débris had collected for years. I secured some good material of *Hydnangium carneum* on top of the ground, but under some six inches in this mat of needles. At the same time I secured specimens of a form that will certainly puzzle one when first found, for it has the appearance of a young *Co-*

prinus micaceus. The pileus is well developed, but the stipe appears to be undeveloped. Then, too, one sees the pseudolamellae and hardly knows what to expect until it is cut open.

Quite strangely, in reporting these specimens, I used almost the same words in describing them as did Dr. Setchell, who described and named this and another species as having been found at Berkeley in 1907; the one I found being somewhat common, the latter rare.

These two are species of the widely distributed, but uncommon genus, *Secotium,* about which there seems to be very little known. The species found as noted above is described by Dr. Setchell as *S. tenuipes,* and anyone having seen his paper cannot mistake this very remarkable fungus.

The other species named by him is even more remarkable, in its imitation of a young, red-capped species of *Russula,* and because of this resemblance it is known as *Elasmomyces russuloides.* It had up to this time proved to be quite rare, and was reported only from Berkeley, California.

During an extended trip to the coast, but only about twenty miles from the above location, late in May of 1917, I came upon a single specimen under a thin covering of laurel leaves. Seen from above, one would invariably take it for a *Russula* unless the description was known, and then only the conspicuous pseudolamellae would reveal its true character. It is a small plant, from two to five centimeters across the pileus, but very attractive.

When I resumed my explorations this spring in the original locality, I persistently encountered this last species, it proving to be quite abundant; so for a time I passed these forms by until some were needed for exhibition at the Wild Flower Fête. I had noticed an occasional form where the hymenium was entirely closed, but still a very definite stipe was present, and the color was almost pure white with no touch of the red. It now seems that I probably have a new form of *Elasmomyces,* as Dr. Setchell has announced very distinct characters for this new form, but more material should be at hand. However, this plant is neither of the two Secotiaceae previously described by him. Casual observation will often leave many fine specimens untouched because

of an external similarity. Another season should develop some definite knowledge of these peculiar forms.

A few days after my discovery of the *Secotium* at Alma, I went again to the Guadaloupe district, and secured after a great deal of hard work some specimens of a *Melanogaster* which so far seems well known and is quite common but as yet is unnamed. I have since collected it frequently and find it very interesting. It is a small, dark-brown or black growth, sometimes covered with a dense, brown, powdery substance that of itself would be a distinctive characteristic. I have found it averaging the bulk of a good-sized marble, and rarely up to the size of an egg and nearly round. It is most frequently found just under the leaves, but I have also discovered it over six inches deep in hard ground, and much wrinkled.

And there is still another strange thing about this fungus. Under coast live-oaks are favorite places for it, especially if the leafy deposit is heavy. Turning these leaves over, the little brown balls are exposed and are seen to be covered with great drops of moisture; and I have found them so day after day during many weeks, and in places where no rain had fallen for many months. As they mature, they become soft and in a way deliquesce. Really, the upper half falls away, exposing the interior, which has melted to a tarry consistency and then run away, carrying the ripe spores into the ground. When first exposed these little plants are often covered with a fine yellow mycelium, but no special point of attachment is seen and older plants do not show it.

It is common, but also very distinctive,—withal a plant not to be tolerated as a familiar companion unless thoroughly dried in the open air or securely pickled.

It seems that the Hymenogastrales are more or less to be associated with powerful aromatic properties, some of which are pleasant, but others powerfully offensive. And this particular *Melanogaster* is the most offensively pungent of them all. While maturing, if left in a room, it will be so strong in an hour's time as to be sickening. I do not wonder that botanists familiar with it find it difficult to select an appropriate name. Certainly, seeing it as I have, none of the offensive names fit; it would take them all and that would not be enough.

This plant is a favorite with the rodents—the wood rats search for it persistently. I have been able to detect it a long distance on a quiet day when the odor penetrates the woods while rats eat it. Proving this to a skeptic this last season afforded much amusement, and also added proof of its qualities. A visitor accompanied me on one occasion in May to this region, and in the woods I soon detected this odor and called attention to it. It was so strong that my friend noticed it, and was able to work down wind to its source under my direction until I pointed out the freshly turned ground and leaves. I induced him to dig among the leaves and he soon found the *Melanogaster*. It seemed almost unbelievable that such a small object could be so pungent.

On this latter occasion, I secured in the débris of a rat's nest a different species, larger, and covered with a very dense golden to reddish powder. Since then I have gathered two additional species, none with the evil odor. The different species are easily distinguishd by their reaction in alcohol, the former turning a deep eosin-red, and the others changing according to the color of their powder or spores.

Referring to these strong odors so characteristic of the Hymenogastraceae, I have found other genera very offensive when carried about in a collection, and this is true particularly with reference to species of *Hysterangium,* while *Rhizopogon* and *Gautieria* are also reported as very powerful. But some species are negative or mild; at least one *Gautieria* is very pleasant and others are bad only after being confined in a collecting case. Both the *Hysterangium* and the *Gautieria* are favorites of the wood rats, and the smell is easily identified at a long distance when the rats are feeding upon them.

Still in a persistent search for truffles, and loath to give up my location at Guadaloupe and seek other ground, I renewed my quest two days after finding the first *Melanogaster* in that vicinity. This took me into the very heart of a dense manzanita thicket, where progress was upon hands and knees. I shortly became involved so completely in the tangle that further progress was impossible. I came to a stop at a huge rat's nest built around an enormous manzanita, and had actually seen the occupants digging for some fungi around its very base. There was noticeable

a very pleasant woodsy odor that I later identified with the fungi they were eating. I found easily one fresh hole about twelve inches in depth in hard soil and could see at the bottom a half eaten fungus. This I secured and found that it was fully as large as an egg. The plant was not plentiful, but after much hard work I secured a total of seven, all deep in hard ground at the base of this nest. They proved to be a species of *Gautieria*. Two species are reported from this state by Dr. Harkness, but they seem to be very rare.

This species possesses an exceedingly powerful smell, which is rather pleasant and easily recognized. The specimens collected were in my possession for a short time, and although securely wrapped and boxed for shipment to Berkeley, they gave off so strong an odor that the house retained traces of it for several days. I have formed a theory of a certain relationship between these hypogaeous forms and the location of rat's nests, and I have so far seen it fairly well verified, for where the fungus is plentiful there the rats are also plentiful, or it may be the other way round.

Within a few days in this same locality, I made a deliberate test of this theory, and without much difficulty after getting a scent I went directly to a small nest in some poison oak and secured three very fine plants. Twice this season I tested the theory, and secured specimens at "The Call" without trouble. On another day when collecting had been very good, and I had overstayed my time at Guadaloupe, as I was making a very hasty departure, going through these same woods, I was attracted by what appeared to be a very fine, large puffball with a white peridium. I reported it as such and created considerable excitement, for it proved to be another *Gautieria* having a peridium at maturity.

These Gautierias have been examined by Professor Zeller, who pronounces them *G. morchellaeformis* and *G. Trabuti*.

March 31, 1917, proved to be a day full of excitement. Professor Setchell reported the day's collection as "amazing," and, when one considers the results obtained, it was most gratifying to me. It was on this day that I found the above *Gautieria* with a peridium. I was still at work on the Guadaloupe district, and had spent an entire morning in the thick woods without results.

At noon I decided to cross to the opposite hillside with its scattered oaks of very large size.

Under a single large tree on a very steep slope, I found a dense mass of leafy humus overlying fine, loose, dry soil. I found a few small *Pezizas* and was encouraged to look farther. When I finished it was nearly sundown and not a foot of soil under that tree had escaped search. On one side was the débris of a rat's nest. The first find of importance was a few small, brown tubers, at first referred to *Tuber candidum*, several specimens of *Genea arenaria, Hydnotrya ellipsospora, Hydnotryopsis Setchelli,* and some others. This was the first collection of truffles, and it now seems that the brown tuber is an unreported species—certainly not *Tuber candidum,* but I have not found it this season of 1918. Many specimens were found both here and at the other location, but very few contained mature spores. I also found them on the coast side of the mountains. *Genea arenaria* is fairly well known, and is well described by Dr. Gilkey in her Revision of the Tuberales of California. Of *Hydnotrya,* but a single specimen had been found in December, 1909, at Pacific Grove. During the season I added nearly a dozen plants to the collection. *Hydnotryopsis,* likewise, was known only by very scanty material, but Dr. Gilkey gave me personal assurance that material sent in that day was sufficient to confirm her description in every detail made from long preserved material in the Harkness collection.

On April 15 I secured another tuber which promises to be in a new genus close to *Piersonia;* according to Dr. Gilkey, but more material must be had if possible. In a good collection made the last of May and examined by Dr. Gilkey, there seems to be another genus which she says is intermediate between *Geopora* and *Hydnotryopsis,* but for the time being the specimens are referred to this latter genus.

I have made frequent reference to the wood rats and their nests, and it is well to explain that in many cases I have been well rewarded by operating around them. The rotten wood and decomposed material that settles around them seems to create ideal conditions for growth of hypogaeous fungi. When one considers the very large number of specimens taken in 1917, as well as the

wide range of species found in close proximity, others may, in searching for such forms, well pay close attention to such places.

How well I was repaid for this observation was shown on April 17, when I was again in the Guadaloupe district. I found some sixty odd specimens of Tuberales, including *Genea, Hydnotrya,* four species of *Tuber,* and some others not as yet identified as to species. The one remarkable feature of these tubers was that there were twenty-five of the brown ones found on March 31. It now began to appear that this was not *Tuber candidum.* I found it in many places during the next two months, and a large amount of material is on hand for the specialist to work over.

Tuber candidum was not found until late in May. The two species are very much alike in size, shape, and color, but my brown tuber is of a solid brown, easily distinguished from *T. candidum,* which has an almost pinkish cast. Both are slightly cracked in radiating lines, with solid, white meat, very sweet and nutty to the taste, but having no particular aroma.

Much additional material was added this season, but nothing like the quantities found last year, although the brown tuber has not been seen. Some very puzzling forms have been found, but not sufficient to be of much value. Two, however, are worth mentioning. One, a single specimen previously reported only from Placerville by Dr. Harkness; the other apparently a new form of *Hydnocystis,* since Dr. Setchell pronounces it not *H. Californica* and this is the only species referred to as Californian by Dr. Gilkey.

On April 15, 1917, I was making an effort to secure more *Gautiera* with a peridium, and toward the close of the day I had worked into the old tangle of manzanita, where I secured a large collection of a white fungus that seemed upon examination to be what I wanted. It proved, however, to be a species of *Hydnangium,* and new to Dr. Setchell. Whether or not it is a described species has not yet been determined.

Another genus not very well known has proved of exceptional interest this year, and this is *Hysterangium.* During the season of 1917 I came upon scattered plants of a single species, with a white peridium and a very tough, gristly interior. This is a verdigris-green-spored species with a most offensive smell. Once

seen, this plant is not easily forgotten. I encountered it quite unexpectedly this season and have been able to study it rather intimately. As the genus seems to be little known, I shall go into some details of its growth and appearance.

It is truly hypogaeous and a gross feeder upon the forest débris, and may be found in all kinds of forests. It prefers no one species of tree, and I have found it equally plentiful under redwoods and live oaks. As one gets into this work, it becomes possible to identify some of the genera by the appearance of the mycelium encountered before the spore-body has been seen. Hysterangium is the easiest to identify and is unmistakable.

This mycelium is white, coarse, and in dense mats often several inches thick and extending over many square feet. In fact, the extent of these mycelial beds is enormous. I have been able to gather sheets of it that looked like lace. The sporophores average at maturity 2.5–3 cm. in diameter, and are nearly round, with a thick, white peridium that turns brown when handled or exposed to the air. This peridium breaks easily and separates from the context. The interior is a tough, green, gristly substance in the center of which there appears to be a well-lined cavity.

I came upon a bed of mycelium in a redwood forest in January last, and followed it to its limits and roughly measured its extent at 500 square feet—I believe this was conservative. In fact, on almost any place within a quarter of a mile on that hillside, this species could be found. The young plants are in a network of this mycelium, but, as it reaches maturity, the threads disappear, leaving the plant near the surface, where it slowly decomposes. I never failed to find this species in quantities, and soon gave up collecting it.

Late in March I was close to this locality, but working along the edge of a grove of live oaks for tubers, when I encountered a bed of this mycelium, and directly I came upon several huge specimens—some as large as eggs. I had found an end of the bed and started to trace its extent. It was less than two feet in width, in gravelly soil, and about every four feet I came upon a cluster of closely crowded, distorted, huge plants. Shortly it entered dense brush, and the spore-bodies no longer appeared. I was able to trace this narrow bed for over two hundred feet, and

then quit in a dense thicket. It never varied from its straight course. The tubers were green-spored but not offensive; the peridium separated more readily, and the central cavity was not present. Radiating from the base were streaks of a gristly substance different in color from the context.

Subsequently, I encountered another extensive bed of a huge species, but the context was purplish at first, later turning to a raw-beef color with streaks of gristle in it. And, still later, I found another of the green-spored species, which was very small. All the others had the white peridium usually separating readily, but in this last species the peridium proved to be very tough. There is considerable material on hand for study, but more is desired and will be sought this coming season.

1234 DELMAS AVENUE,
SAN JOSE, CALIFORNIA.

CUBAN POLYPORES AND AGARICS

William A. Murrill

POLYPORACEAE

Hymenophore entirely resupinate, never reflexed.	Tribe 1. Porieae.
Hymenophore normally pileate, often effused-reflexed, sometimes varying to resupinate.	
Hymenium porose.	
Hymenophore annual.	Tribe 2. Polyporeae.
Hymenophore perennial.	Tribe 3. Fomiteae.
Hymenium furrowed.	Tribe 4. Daedeleae.

Tribe 1. Porieae

a. White or bright-colored species

Polyporus (Resupinati)
- carneopallens Berk. Dead wood.
- excurrens Berk. & Curt. Under side of old logs.
- rivulosus Berk. & Curt. Dead polypores.
- vaporarius Fries. Dead wood.
- vinctus Berk. Dead wood.
- vulgaris Fries. Dead wood.
- xantholoma Schw. Dead wood.

Poria
- phlebiaeformis Berk. Rotten wood.

b. Brown or dark-colored species

Fomitiporella
- altocedronensis Murrill. Dead trunk in a forest.

Fomitiporia
- cubensis Murrill. Old log in a field.
- flavomarginata Murrill. Decayed hardwood logs in a forest.

Fuscoporella
- coruscans Murrill. Decayed hardwood logs in a forest.
- palmicola (Berk. & Curt.) Murrill. Dead stipes of a prickly palm.

Fuscoporia
- ferruginosa (Schrad.) Murrill. Dead hardwood.
- rufitincta (Cooke) Murrill. Dead wood.

Melanoporella
- carbonacea (Berk. & Curt.) Murrill. Dead trunks.

Tinctoporia
- aurantiotingens (Ellis & Macbr.) Murrill. Decayed hardwood logs.

Tribe 2. POLYPOREAE

CERRENELLA

FARINACEA (Fries) Murrill. Decaying branches of hardwood trees.

COLTRICIA

SPATHULATA (Hook.) Murrill. Dead wood, often on roots.

CORIOLELLUS

SEPIUM (Berk.) Murrill. Structural timber and other dead wood.

CORIOLOPSIS

CAPERATA (Berk.) Murrill. Dead wood.
CIRRIFER (Berk. & Curt.) Murrill. Dead logs.
CROCATA (Fries) Murrill. Dead hardwood logs.
FULVOCINEREA Murrill. Dead wood.
NIGROCINEREA Murrill. Dead wood.
OCCIDENTALIS (Klotsch) Murrill. Dead wood.
RIGIDA (Berk. & Mont.) Murrill. Dead wood.
SUBGLABRESCENS Murrill. Dead wood.
TAYLORI Murrill. Dead logs.
VIBRATILIS (Berk. & Curt.) Murrill. Dead wood.

CORIOLUS

ABIETINUS (Dicks.) Quél. Dead pine trunks.
ARMENICOLOR (Berk. & Curt.) Murrill. Dead wood.
BRACHYPUS (Lév.) Murrill. Dead wood.
DELECTANS Murrill. Dead hardwood trunk in a forest.
DEPAUPERATUS (Pat.) Murrill. Dead wood.
FULVO-UMBRINUS Murrill. Old timber near the beach.
HAEDINUS (Berk.) Pat. Dead wood.
MAXIMUS (Mont.) Murrill. Dead logs.
MEMBRANACEUS (Sw.) Pat. Dead wood.
NIGROMARGINATUS (Schw.) Murrill. Dead wood.
OCHROTINCTELLUS Murrill. Dead wood.
PALLIDOFULVELLUS Murrill. Dead wood.
PAVONIUS (Hook.) Murrill. Dead hardwood logs.
PINSITUS (Fries) Pat. Dead wood.
PROLIFICANS (Fries) Murrill. Dead wood.
SECTOR (Ehrenb.) Pat. Dead wood.
SERICEOHIRSUTUS (Klotsch) Murrill. Dead trunks of red cedar.
SOBRIUS (Berk. & Curt.) Murrill. Dead wood.
VERSICOLOR (L.) Quél. Dead wood.

CYCLOPORELLUS

IODINUS (Mont.) Murrill. Dead hardwood.

BJERKANDERA

ADUSTA (Willd.) P. Karst. Dead wood.
ALBOSTYGIA (Berk. & Curt.) Murrill. Dead wood.
SUBSIMULANS Murrill. Dead trunks.
TEREBRANS (Berk. & Curt.) Murrill. Dead trees.

EARLIELLA

CORRUGATA (Pers.) Murrill. Dead hardwood trunks.

FAVOLUS

TENUIS (Hook.) Murrill. Dead hardwood trunks and branches.

VARIEGATUS (Berk.) Murrill. Dead wood.

FLAVIPORELLUS

SPLITGERBERI (Mont.) Murrill. Dead wood.

FLAVIPORUS

CROCITINCTUS (Berk. & Curt.) Murrill. Dead wood.

RUFOFLAVUS (Berk. & Curt.) Murrill. Dead wood.

FUNALIA

ACULEIFER (Berk. & Curt.) Murrill. Dead wood.

CLADOTRICHA (Berk. & Curt.) Murrill. Dead wood.

HISPIDULA (Berk. & Curt.) Murrill. Dead wood.

VERSATILIS (Berk.) Murrill. Dead wood.

HAPALOPILUS

GILVUS (Schw.) Murrill. Dead wood.

LICNOIDES (Mont.) Murrill. Dead wood.

HEXAGONA

BRUNNEOLA (Berk. & Curt.) Murrill. Dead wood.

CUCULLATA (Mont.) Murrill. Dead wood.

DAEDALEA (Link) Murrill. Dead wood.

FRAGILIS Murrill. Dead wood.

PRINCEPS (Berk. & Curt.) Murrill. Dead wood.

PURPURASCENS (Berk. & Curt.) Murrill. Trunks of trees.

SUBCAPERATA Murrill. Decayed logs.

TESSELLATULA Murrill. Dead wood.

INONOTUS

CORROSUS Murrill. Dead trunks and vines.

FRUTICUM (Berk. & Curt.) Murrill. Living twigs of orange and oleander.

PERTENUIS Murrill. Dead wood.

IRPICIPORUS

CUBENSIS (Berk. & Curt.) Murrill. Dead wood.

LACTEUS (Fries) Murrill. Dead wood.

LAETIPORUS

SPECIOSUS (Batt.) Murrill. Living trunks of various trees.

MICROPORELLUS

DEALBATUS (Berk. & Curt.) Murrill. Dead wood.

HOLOTEPHRUS (Berk. & Curt.) Murrill. Dead wood.

PORPHYRITIS (Berk.) Murrill. Dead wood.

NIGROPORUS

VINOSUS (Berk.) Murrill. Dead wood.

PHAEOLUS

SISTOTREMOIDES (Alb. & Schw.) Murrill. Trunks, stumps, and roots of pine.

POGONOMYCES

HYDNOIDES (Sw.) Murrill. Dead wood.

POLYPORUS

ACICULA Berk. & Curt. Dead wood.

AEMULANS Berk. & Curt. Dead wood.

ARCULARIUS (Batsch.) Fries. Dead wood.

BLANCHETIANUS Berk. & Mont. Dead wood.

cyathiformis Lév. Dead logs.
discoideus Berk. & Curt. Dead wood.
hydniceps Berk. & Curt. Dead wood.
scabriceps Berk. & Curt. Dead wood.
Tricholoma Mont. Dead sticks and logs in woods.
tuba Berk. & Curt. Dead wood.
virgatus Berk. & Curt. Dead wood.
Wrightii Murrill. Dead wood.

Pycnoporus
sanguineus (L.) Murrill. Dead wood.

Rigidiporus
contrarius (Cooke) Murrill. Dead trunks.
evolutus (Berk. & Curt.) Murrill. Dead wood.
Liebmanni (Fries) Murrill. Dead wood.
microstomus (Berk. & Curt.) Murrill. Dead wood.
substereinus Murrill. Dead sticks in woods.
surinamensis (Miq.) Murrill. Water-soaked hardwood trunks.

Spongipellis
hydrophilus (Berk. & Curt.) Murrill. Dead logs.
substuppeus (Berk. & Cooke) Murrill. Dead wood.

Spongiporus
altocedronensis Murrill. Dead wood.

Trametes
cubensis (Mont.) Sacc. Dead logs.
havannensis (Berk. & Curt.) Murrill. Dead wood.
nivosa (Berk.) Murrill. Dead wood.
submurina Murrill. Old logs.

Trichaptum
trichomallum (Berk. & Mont.) Murrill. Dead logs.

Tyromyces
albogilvus (Berk. & Curt.) Murrill. Dead trunks in woods.
fulvitinctus (Berk. & Curt.) Murrill. Dead wood.
leucomallus (Berk. & Curt.) Murrill. Dead wood.
nivosellus Murrill. Dead palm trunks.
Palmarum Murrill. Dead palm logs.
palustris (Berk. & Curt.) Murrill. Pine trunks.
versicutis (Berk. & Curt.) Murrill. Dead wood.

Tribe 3. Fomiteae

Amauroderma
Chaperi (Pat.) Murrill. Dead wood.
regulicolor (Cooke) Murrill. Decaying roots of hardwood trees.

Elfvingia
fasciata (Sw.) Murrill. Dead trunks of trees.
tornata (Pers.) Murrill. Decayed logs and stumps.

Fomes
Auberianus (Mont.) Murrill. Dead or wounded hardwood trunks.
ligneus (Berk.) Cooke. Dead wood.
Sagraeanus (Mont.) Murrill. Dead logs and stumps.

SUBFERREUS Murrill. Hardwood logs.
TURBINATUS (Pat.) Murrill. Decayed trunks and branches.
UNGULATUS (Schaeff.) Sacc. Pine trunks.

FOMITELLA
SUPINA (Sw.) Murrill. Dead wood.

FULVIFOMES
CALCITRATUS (Berk. & Curt.) Murrill. Dead wood.
DEPENDENS Murrill. Trunks of living hardwood trees.
EXTENSUS (Lév.) Murrill. Decayed trunks.
SUBPECTINATUS Murrill. Dead wood.
SWIETENIAE Murrill. Mahogany stumps.
UNDERWOODII Murrill. Dead wood.
YUCATANENSIS Murrill. Dead trunks and stumps.

GANODERMA
ARGILLACEUM Murrill. Dead trunks.
PERZONATUM Murrill. Mango logs.
PRAELONGUM Murrill. Dead wood.
PULVERULENTUM Murrill. Dead wood.
SUBINCRUSTATUM Murrill. Dead wood.
TUBERCULOSUM Murrill. Dead wood.

NIGROFOMES
MELANOPORUS (Mont.) Murrill. Dead or diseased trunks of trees.

PYROPOLYPORUS
ROSEOCINEREUS Murrill. Dead wood.

DOUBTFUL SPECIES OF FOMITEAE

Polyporus
sclerodes Berk. & Curt. Dead wood.
scleromyces Berk. & Curt. Dead wood.
subflexibilis Berk. & Curt.

Ptychogaster cubensis Pat. Base of trunks.

Tribe 4. DAEDALEAE

DAEDALEA
AMANITOIDES Beauv. Dead wood.
SPRUCEI Berk. Dead or living trunks.

GLOEOPHYLLUM
BERKELEYI (Sacc.) Murrill. Pine railway ties and other forms of dead coniferous wood.
STRIATUM (Sw.) Murrill. Dead wood.

LENZITES
CUBENSIS Berk. & Curt. Dead wood.

DOUBTFUL SPECIES OF DAEDALEAE

Daedalea violacea Lév.

AGARICACEAE

Hymenium plicate, the folds obtuse. — Tribe 1. CHANTERELEAE.
Hymenium truly lamellate.
  Context composed mostly of swollen, vesicular cells. — Tribe 2. LACTARIEAE.
  Context composed of slender, elongate cells. — Tribe 3. AGARICEAE.

Tribe 1. CHANTERELEAE

ASTEROPHORA
  CLAVUS (Schaeff.) Murrill. Decaying agarics.
PLICATURA
  LATERITIA (Berk. & Curt.) Murrill. Dead trunks and vines.
  OBLIQUA (Berk. & Curt.) Murrill. Dead wood.

Tribe 2. LACTARIEAE

No species of *Lactaria* or *Russula* are known from Cuba.

Tribe 3. AGARICEAE

Spores white in mass, rarely tinged or becoming tinged with yellow, green, violet, or brown. — Subtribe 1. LEPIOTANAE.
Spores rosy or rosy-ochraceous in mass. — Subtribe 2. PLUTEANAE.
Spores ochraceous, ferrugineous, or fulvous in mass. — Subtribe 3. PHOLIOTANAE.
Spores brown, purplish-brown, or black in mass. — Subtribe 4. AGARICANAE.

Subtribe 1. LEPIOTANAE

ARMILLARIA
  ALPHITOPHYLLA (Berk. & Curt.) Murrill. Exposed hardwood logs and decayed spots on standing trunks.
  PUTRIDA (Scop.) Murrill. Stumps and buried roots.
CREPIDOPUS
  CAVEATUS (Berk. & Curt.) Murrill. Dead standing trunks and logs.
  COMMISCIBILIS (Berk. & Curt.) Murrill. Logs in woods.
  EUGENIAE (Earle) Murrill. Dead trunks and roots of *Eugenia Jambos*.
  HEMIPHLEBIUS (Berk. & Curt.) Murrill. Dead wood.
CRINIPELLIS
  SCABELLA (Alb. & Schw.) Murrill. Dead stems, roots, and leaves.
  STUPPARIA (Berk. & Curt.) Pat. Dead sticks in woods.
GEOPETALUM
  COPULATUM (Ehrenb.) Murrill. Cocoanut petioles and other dead wood in shaded places.
  FLAVOLANATUM (Berk. & Curt.) Murrill. Fallen sticks.
  HAEDINUM (Berk. & Curt.) Murrill. Dead wood.
  SEMITECTUM (Berk. & Curt.) Murrill. Logs in dense woods.
  SUBELATINUM Murrill. Decayed wood.
GYMNOPUS
  BORYANUS (Mont.) Murrill. Dead trunks.
  CHRYSOPEPLUS (Berk. & Curt.) Murrill. Dead wood.
  MUSICOLA Murrill. Banana trash.

NIGRITA (Berk. & Curt.) Murrill. Dead wood.
TENUIPES (Schw.) Murrill. Dead wood.

HIATULA
PURPURASCENS Berk. & Curt. Decayed leaves.

HYDROCYBE
EARLEI Murrill. Ground in pasture.

HYGROPHORUS
SUBPRATENSIS Murrill. Banana trash and on lawns.

LACCARIA
LACCATA (Scop.) Berk. & Br. Ground in woods or open places.

LENTINULA
DETONSA (Fries) Murrill. Dead wood.

LENTINUS
CRINITUS (L.) Fries. Exposed logs and stumps.
GRAMINICOLA Murrill. Old grass roots.
HIRTUS (Fries) Murrill. Dead wood.
STRIGELLUS Berk. & Curt. Dead wood.
STRIGOSUS (Schw.) Fries. Old logs and stumps.
VELUTINUS Fries. Dead wood.

LENTODIELLUM
CONCAVUM (Berk.) Murrill. Dead logs and stumps.

LENTODIUM
SQUAMOSUM (Schaeff.) Murrill. Structural timbers and logs, especially of coniferous trees.

LEPIOTA
ABRUPTIBULBA Murrill. Ground in banana fields and thickets.
CRETACEA (Bull.) Morgan. Rich soil in cultivated grounds or woods.
FLAVODISCA Murrill. Bermuda grass sod.
HEMISCLERA (Berk. & Curt.) Sacc. Logs in woods.
LACTEA Murrill. Ground in banana fields.
LONGISTRIATA Peck. Soil in woods or cultivated grounds.
RIMOSA Murrill. Ground in gardens.
SUBCLYPEOLARIA (Berk. & Curt.) Sacc. Roots of trees or dead wood.

MARASMIELLUS
INCONSPICUUS Murrill. Dead sticks.
PURPUREUS (Berk. & Curt.) Murrill. Stumps in woods.

MARASMIUS
ACICULAEFORMIS Berk. & Curt. Sticks in woods.
ALBOFUSCUS Berk. & Curt. Logs in woods.
ATROVIRIDIS Berk. & Curt. Decayed wood in thickets.
BADIUS Berk. & Curt. Bark in moss.
CHRYSOCHAETES Berk. & Curt. Dead leaves.
CORACICOLOR Berk. & Curt. Logs in woods.
CORACIPES Berk. & Curt. Woods.
CRESCENTIAE Murrill. Decaying fruits of calabash.
CUBENSIS Berk. & Curt. Dead wood.
CYATHIFORMIS Berk. & Curt. Dead wood.
FIBROSIPES Berk. & Curt. Dead wood.
FLAVELLUS (Berk. & Curt.) Murrill. Sticks in woods.

GRAMINIS Murrill. Dead Bermuda grass on lawns.
GUYANENSIS Mont. Dead leaves.
HAEMATOCEPHALUS (Mont.) Berk. & Curt. Fallen decayed leaves and wood.
HEMILEUCUS (Berk. & Curt.) Murrill. Dead leaves and sticks.
HINNULEUS Berk. & Curt. Dead leaves.
INEQUALIS Berk. & Curt. Dead sticks.
MUSICOLA Murrill. Decaying banana trash.
PERSONATUS Berk. & Curt. Dead leaves.
PETIOLORUM Berk. & Curt. Leaf petioles and nerves.
PICIPES Murrill. Fallen leaves of rose-apple.
PROLETARIUS Berk. & Curt. Dead sticks.
PRUINOSULUS Murrill. Dead grass stems.
PURPURASCENS Berk. & Curt. Sticks in shady woods.
PUTREDINIS Berk. & Curt. Decayed wood in forests.
RUGULOSUS Berk. & Curt. Sticks and leaves in woods.
SERICIPES Berk. & Curt. Dead sticks in woods.
STENOPHYLLUS Mont. Banana trash and decayed stalks and logs.
STYLOBATES Berk. & Curt. Decayed wood.
SUBGLOBOSUS Berk. & Curt. Sticks in woods.
SULCATIPES Murrill. Fallen dead leaves.
SYNODICUS (Kuntze) Fries. Dead sticks, leaf-stalks, grass, etc.
TENEBARUM Berk. & Curt. Sticks in woods.
TORTIPES Berk. & Curt. Decayed wood.
UNDERWOODII Murrill. Cocoanut petioles.
VIRIDIFUSCUS Berk. & Curt. Dead sticks in mountains.

MELANOLEUCA
HOLOPORPHYRA (Berk. & Curt.) Murrill. Rotten logs in woods and rich soil in coffee plantations.

MICROMPHALE
BRUNNESCENS Earle. Dead wood among mosses.
FUSCIFRONS (Berk. & Curt.) Murrill. Dead wood.
SUBEXCAVATUM Murrill. Dead wood.

OMPHALINA
CHONDRIPES (Berk. & Curt.) Murrill. Dead wood or other decayed vegetable matter.
COCCINEA Murrill. Rotten wood.
EARLEI Murrill. Soil under weeds and bushes.
FLAVELLA (Berk. & Curt.) Murrill. Dead sticks in woods.
MINIATA Murrill. Rotten wood.

OMPHALOPSIS
CAMPANELLA (Batsch) Earle. Rotten coniferous wood.
CITRICOLOR (Berk. & Curt.) Murrill. Dead leaves.
EUSPEIREA (Berk. & Curt.) Murrill. Dead logs in woods.

PANELLUS
CANTHARELLOIDES (Mont.) Murrill. Dead wood.
EUGRAMMUS (Mont.) Murrill. Dead wood.
SUBCANTHARELLOIDES Murrill. Old roots.

PLEUROTOPSIS
ARACHNOIDEA (Berk. & Curt.) Murrill. Dead wood.

POLYMARASMIUS
MULTICEPS (Berk. & Curt.) Murrill. Dead logs in woods.
SARMENTOSUS (Berk.) Murrill. Dead wood and leaves.

PRUNULUS
CARBONICOLA Murrill. Burnt sticks.
RORIDULUS (Berk. & Curt.) Murrill. Rotten wood.

RESUPINATUS
CUBENSIS Murrill. Dead sticks.
SUBBARBATULUS Murrill. Dead logs.
SUBBARBATUS (Berk. & Curt.) Murrill. Dead logs.

SCHIZOPHYLLUS
ALNEUS (L.) Schroet. Dead wood.

SCYTINOTUS
CONCOLOR (Berk. & Curt.) Murrill. Dead sticks and leaves in woods.
HAEMATODES (Berk. & Curt.) Murrill. Dead sticks.

DOUBTFUL SPECIES OF LEPIOTANAE

Agaricus rubrotinctus Berk. & Curt. On earth in woods.
Lentinus glabratus Mont. Compare *Lentinula detonsa*.
Pocillaria reflexa Earle. Compare *Lentinus crinitus*.

Subtribe 2. PLUTEANAE

ECCILIA
CUBENSIS Murrill. Moist thickets.
EARLEI Murrill. Dead sticks.

LEPTONIELLA
EARLEI Murrill. Ground in woods.
HYPOPORPHYRA (Berk. & Curt.) Murrill. Woods.

NOLANEA
CUBENSIS Murrill. Fallen dead wood in coffee groves.

PLEUROPUS
EARLEI Murrill. Ground in banana fields.

PLUTEUS
AETHALUS (Berk. & Curt.) Sacc. Dead wood.
CERVINUS (Schaeff.) Quél. Dead wood.
EARLEI Murrill. Dead logs.
LAETIFRONS (Berk. & Curt.) Sacc. Dead wood.
NITENS Pat. Dead wood.
TEPHROSTICTUS (Berk. & Curt.) Sacc. Under side of old logs.

VOLVARIOPSIS
BAKERI Murrill. Dead banana stumps.
BOMBYCINA (Schaeff.) Murrill. Dead spots in living trunks, or dead logs.
CUBENSIS Murrill. Ground in banana fields.
EARLEI Murrill. Ground in banana fields.

Subtribe 3. PHOLIOTANAE

CREPIDOTUS
CACAOPHYLLUS (Berk. & Curt.) Sacc. Dead wood.
PYRRHUS (Berk. & Curt.) Sacc. Dead wood.

SUBSTIPITATUS Murrill. Fallen dead twigs.
SULCATUS Murrill. Fallen dead branches.

GALERULA
CRISPA (Longyear) Murrill. Manure or manured ground.
HYPNI (Batsch) Murrill. Among mosses or grasses in shaded places.
MARTIANA (Berk. & Curt.) Murrill. Dead wood.
TENERA (Schaeff.) Murrill. Lawns or pastures, rarely in woods.

GYMNOPILUS
AREOLATUS Murrill. Decaying stumps.
AUREOBRUNNEUS (Berk. & Curt.) Murrill. Dead logs and stumps.
CHRYSOPELLUS (Berk. & Curt.) Murrill. Dead wood.
CHRYSOTRICHOIDES Murrill. Dead cocoanut logs.
CHRYSOTRICHUS (Berk. & Curt.) Murrill. Dead logs in fields.
HELVOLICEPS (Berk. & Curt.) Murrill. Dead logs in woods.
HISPIDELLUS Murrill. Old logs.
PALMICOLA Murrill. Dead logs.
PENETRANS (Fries) Murrill. Dead pine wood.
PHOLIOTOIDES Murrill. Dead royal palm trunks.
SUBPENETRANS Murrill. Dead wood.
TENUIS Murrill. Dead wood.

HEBELOMA
CUBENSE Murrill. Soil in gardens.

HYPODENDRUM
SCOBIFER (Berk. & Curt.) Murrill. About roots of trees.

MYCENA
JALAPENSIS Murrill. Among chips in woods or on rotting grass in fields.

NAUCORIA
OINODES (Berk. & Curt.) Sacc. Dead wood.
SEMIORBICULARIS (Bull.) Quél. Open manured ground.
SUBPECTINATA Murrill. Dead logs.
UNDERWOODII Murrill. Dead wood.

PHOLIOTA
CUBENSIS Earle. Ground under buildings.
MUSAE (Earle) Murrill. Dead banana stalks.

Subtribe 4. AGARICANAE

AGARICUS
BAMBUSIGENUS Berk. & Curt. Dead bamboo roots.
CAMPESTER L. Manured cultivated ground.
EARLEI Murrill. Red soil in banana fields.
HORNEI Murrill. Soil in fields.
HERRADURENSIS Murrill. Soil in gardens.
OCHRACEIDISCUS Murrill. Red soil on ditch banks.
PRAEMAGNUS Murrill. Grass near manure heaps.
SHAFERI Murrill. Soil.

ATYLOSPORA
COPRINOCEPS (Berk. & Curt.) Murrill. Dead logs.
CUBENSIS Murrill. Ground along paths.
EUTHUGRAMMA (Berk. & Curt.) Murrill. Dead wood.

MUSAE (Earle) Murrill. Dead banana trees.
PLUMIGERA (Berk. & Curt.) Murrill. Dead sticks in woods.
ROYSTONIAE (Earle) Murrill. Dead royal palm logs.

CAMPANULARIUS
CAMPANULATUS (L.) Earle. Manure or manured ground.
SOLIDIPES (Peck) Murrill. Horse manure.

COPRINUS
CUBENSIS Berk. & Curt. Dead logs.
SPRAGUEI Berk. & Curt. Open ground.

DECONICA
BULLACEA (Bull.) Sacc. Horse manure.
SCATIGENA (Berk. & Curt.) Sacc. Horse manure.

DROSOPHILA
APPENDICULATA (Bull.) Quél. Stumps and buried wood.
ATRICASTANEA Murrill. Buried wood in banana fields.
BREVIPES Murrill. Red clay soil.
CAESPITOSA (Earle) Murrill. Base of stumps in open ground.
CAMPESTRIS (Earle) Murrill. Bermuda grass lawns.
FLOCCULOSA (Earle) Murrill. Red earth under buildings.
PALLIDISPORA Murrill. Soil in gardens.
TENUIS Murrill. Ground in woods.

MELANOTUS
FUMOSIFOLIUS Murrill. Dead banana leaves or dead logs.
MUSICOLA (Berk. & Curt.) Murrill. Dead plantain leaves.

PSATHYRELLA
CUBENSIS Murrill. Clay soil in banana fields.
EARLEI Murrill. Buried wood in banana fields.
MINUTULA (Schaeff.) Murrill. Decayed wood and soil rich in humus.
STEVENSONII Murrill. Rich exposed soil.

PSILOCYBE
DICHROMA (Berk. & Curt.) Sacc. Dead wood.
PALMIGENA (Berk. & Curt.) Sacc. Palm stumps in woods.
PLUTONIA (Berk. & Curt.) Sacc. Dead wood.

STROPHARIA
CAESPITOSA Murrill. Red clay soil under houses.
CUBENSIS Earle. Pastures and manured ground.
FLOCCOSA Earle. Ground in the open.

DOUBTFUL SPECIES OF AGARICANAE

Psilocybe subviridis (Berk. & Curt.) Sacc. Dead wood.

NEW YORK BOTANICAL GARDEN.

CHARLES HORTON PECK

STEWART H. BURNHAM

" Lift the veil of interception between your vision and the most lonely spot in the heart of the Adirondack wilderness on some fair day, and you may see a man examining a vine his sharp eye has dectected in the tangled undergrowth. The man's figure is sparse and lithe and a little stooped. His hair is partially gray, his eyes glow with delight. 'A new species!' he breathes half audibly. Charles H. Peck, state botanist, has added another specimen to his long list of the various members of the New York state flora, and it will soon be placed among his treasures in the state herbarium."

Again we will lift the veil and go back eighty-five years. Charles Horton Peck, son of Joel B. and Pamelia Horton Peck, of English descent, was born in the northeastern part of the town of Sand Lake, March 30, 1833. "Sand Lake, Rensselaer county, was just a few clearings less than an unbroken forest then." About 1794, "his great grandfather, Eleazer Peck, removed from Farmington, Conn., to Sand Lake, N. Y., being attracted there by the oak timber, from which were manufactured staves for the Albany market."

As soon as Dr. Peck was old enough to be of assistance in his father's sawmill, at the foot of Larnard hill, his schooldays were limited to the winter season. "The schoolhouse that provided shelter for the master and a few children from the nearest homes was built of logs. The seats were made of saw-log slabs turned flat side up."

Speaking of the abundance of passenger pigeons in Sand Lake when he was a boy, he remarked that they were fond of red and black elderberries and buckwheat. He recalled going one time with his grandfather, who enjoyed fishing and hunting, to catch pigeons with a net, using a decoy and working the net from a brush hut nearby. During the morning the pigeons came down,

but, on pulling the net, it broke on account of age and most of the birds got away. It was late afternoon before they succeeded in getting the pigeons to come around again. The net had been mended and they had gone without their dinner; but this time two dozen or more birds were captured.

Dr. Peck first went to the Cranberry marsh at Sand Lake with his father, when eight or ten years old, to pick large cranberries,

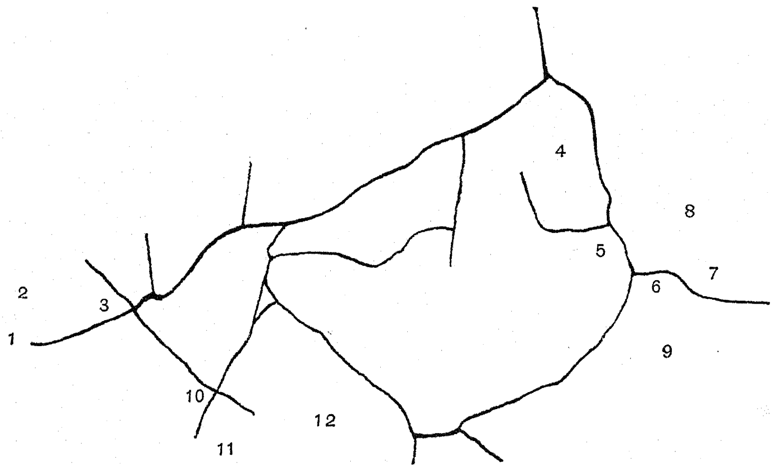

FIG. 1. Sketch showing the roads leading from Averill Park to Cranberry Marsh and the birthplace of Dr. Peck. 1, Averill Park, 800°; 2, Sand Lake; 3, Sand Lake Village; 4, Big Bowman Pond, 1500°; 5, Little Bowman Pond; 6, Birthplace of Dr. Peck; 7, Taberton; 8, Cranberry Marsh; 9, Larnard Hill, 1800°; 10, Glasshouse; 11, Glass Lake; 12, Bear's Head.

which were then abundant. The trail for a mile or so led through the dense forest. The marsh was very soft and quaking, but now it is growing firm from the cutting away of the forest, which causes a drying out of the soil so that less water reaches the marsh. It is mostly shaded by shrubs, tamaracks, spruces, and balsam firs. The large cranberry and the pitcher plant are now found only along the stream flowing through the marsh and in one or two wet, circular openings near the lower end. Sixty years ago the foreign population of Sand Lake and Berlin nearly eradicated the Sarracenia, upon learning from the Shakers that the roots had a medicinal value in the treatment of smallpox. About this time, also, the women and children dug goldthread

extensively from the mossy knolls under the spruces and balsams about the border of the swamp.

One could thrust a pole for eight or ten feet through the soft ooze in those days. The marsh was well known to the Indians, who came from the Hudson to gather cranberries; and Dr. Peck's great-grandmother once went with them and is said to have been the first white woman to visit the marsh. It lies about twelve hundred feet above the Hudson, in the northeastern part of the town of Sand Lake; a walk of five miles from Averill Park, and about three fourths of a mile from the German Hotel. One finds both black and red spruce on the marsh, although, according to Sargent, the latter species is confined to uplands. A list of the plants of Cranberry Marsh is given in the N. Y. State Mus. Bull. 150: 71–72. 1911.

In 1841, Dr. Peck made his first visit to Albany and ten years later he entered the State Normal School, which was located where the Christian Brothers Academy now stands, at the rear of Geological Hall. While at the Normal, he met a young lady at his boarding-house who was to take a class in botany and natural history in a city Jewish school, and desired some one to go to the woods and fields to hunt flowers for class study. By accident, the lot fell to Dr. Peck, who consented to go for her, and thereby awakened an interest in the subject which shaped and directed his whole future career. "Thus it often happens that apparently trifling circumstances give a color and character to the history of an individual which are far reaching in their influence and most important in their final results."

Dr. Peck was one of the first to join Prof. J. H. Salisbury's voluntary class in botany, taking it as an extra study, as it was not at that time included in the curriculum of the Normal School. Graduating from the Normal in 1852, on returning home, he was put to work in the hayfield, but all his spare time was spent in collecting and analyzing plants. During the winter of 1852–1853, he successfully taught a large district school, having an average attendance of about sixty pupils, in Poestenkill, Rensselaer County.

Dr. Peck now determined to prepare himself for a college course, and took his classical preparatory course at the Sand

Lake Collegiate Institute. He entered Union College in the fall of 1855, and received the degree of bachelor of arts in 1859. So high was his standing that he was one of three members of his class to be awarded the Nott Prize Scholarship, an honor given only to those who passed a special thorough and extended examination. While at Union, he received his botanical instruction from Prof. Jonathan Pearson; and, in place of athletics, he made botanical excursions. He was a member of the Phi Beta Kappa Literary Society of Union College.

Just before graduation, Dr. Peck accepted a position as teacher in classics, mathematics, and botany in the Sand Lake Collegiate Institute, which position he held for about three years. He married Mary Catherine Sliter, the daughter of Calvin and Anna Maria Sliter, of Snyders Corners, Rensselaer County, April 10, 1861. He had two sons: Harry Sliter, born 1863, and Charles Albert, born 1870. Mrs. Peck died February 26, 1912.

Soon after his marriage, he was one day putting a stick of wood in the stove and noticed a moss upon it. He became interested, and went to Brooklyn, where he met Prof. Alphonse Wood and was advised to get Sullivant's work on mosses, which appeared in the earlier editions of Gray's Manual. Equipped with the Manual and a $12.00 microscope, he returned home and began the study of bryology independent of a teacher or collection. He would search for the name of a moss for hours, if necessary, reading each description as he went along until he found the one that fitted his specimen.

Afterwards, while teaching in Albany, he presented his collection to the State; and it was there seen by Judge Geo. W. Clinton, of Buffalo, one of the regents, who was finally instrumental in securing Dr. Peck's appointment in the State Cabinet of Natural History. The "Catalogue of Mosses presented to the State of New York by Charles H. Peck" is published in Ann. Rep. State Cab. Nat. Hist, **18**: 193–194. 1865. He states that "of the 144 species named . . . 104 were found in the town of Sand Lake."

In 1862 he received the degree of master of arts from Union; and, in the same year, he was instructor in the classical department of the State Street High School at Albany, a private school for boys under the control and principalship of Levi Cass. Dr.

Peck would often relate how on Monday mornings, when the boys came in from their Sunday holiday unprepared in their lessons, instead of flogging them, he would take from his desk plants which he cherished and talk to the boys about them.

On the first of January, 1867, he was appointed by the State to fill the herbarium with specimens representing the plant life of the State. There were at that time about 1,800 specimens in the collections of the State Cabinet of Natural History; but, at the close of Dr. Peck's career, the herbarium of the State Museum contained many thousands of specimens, including thousands of priceless mycological collections.

Rev. Moses A. Curtis, of North Carolina, first gave Dr. Peck a start in the fungi, which was the beginning of the mycological collection of the State Herbarium—a collection, the gathering and study of which has given him a world-wide name for all time.

In 1868, Dr. Peck visited the Adirondacks and climbed Wallface without a guide. A very sudden, cold rainstorm came up, and on attempting to descend the mountain in the clouds, he fortunately came upon a camp well supplied with food and blankets and was thus saved from great peril. After this experience, he seldom attempted to climb the higher Adirondacks alone.

He visited North Elba a score or more times, and climbed Mt. Marcy eleven times, usually taking two days for the trip. This high peak "is in the center of a very rugged mountainous region, where high peaks separated by deep and narrow valleys rise on all sides. From its summit an observer may look in every direction, and obtain views unsurpassed in beauty and grandeur. A visit to this lofty station necessitates a tiresome walk of six or seven miles through the woods over a rough trail and up some steep acclivities. But the attraction of the place, the magnificent views it affords and the richness of its flora bring many visitors, and few return without feeling well rewarded for the labor and expense incurred." The reports of the Adirondack and State Land Survey, by Verplanck Colvin, 1880, 1891, contain preliminary lists of the plants of the summit of Mt. Marcy; and the N. Y. State Mus. Bull. **25**: 657–673. 1899, a more complete annotated list.

In 1883, a law was passed creating the office of State Botanist; and Dr. Peck was appointed by the Regents to fill the position.

At the 112th Commencement of Union College, June 10, 1908, in presenting Dr. Peck for his degree, Chairman Brownell said:

"By the direction of the Board of Trustees, I present for the degree of Doctor of Science, Charles Horton Peck of the Class of 1859. A graduate of this College, he has been for many years in public service as Botanist of the Empire State, Author, and Student of Nature and of Science. I request that the degree be conferred upon him."

President Alexander conferred the degree in the following words:

"Charles Horton Peck. For faithful labors and high attainments in the realm of Science and for long and fruitful service, by the authority committed to me by the Trustees of Union College I confer upon you the degree of Doctor of Science and bid you enjoy all the rights, privileges and immunities pertaining thereto."

Dr. Peck retired from his position of State Botanist early in 1915, after a period of forty-eight years of faithful, conscientious, and honest service. He died at his home in Menands, July 11, 1917; and was buried in the family plot in Sand Lake Cemetery near Averill Park.

Dr. Peck was the author of many botanical articles and reports, preëminent among which is the long series of annual reports of the State Botanist from 1867 to 1912. He was a Fellow of the American Association for the Advancement of Science; a member of the Botanical Society of America; of the Albany Historical and Art Society; American Forestry Association; National Geographic Society; New England Botanical Club; and many mycological and scientific societies; and was a devout member of the Presbyterian church for over sixty years.

"Dr. Peck has accomplished a great work. He has built a gigantic monument to himself by his long labor in the herbarium. He has wandered over every section of the State from the Adirondack wilds to the Montezuma marshes, and westward to the grape belt along the shores of Lake Erie."

"Without the advantages of European travel and study, and frequently working without access to the older European literature upon fungi, his work stands out with conspicuous individ-

uality." "Anyone who has ever strolled into the great open field of mycology will meet with his alluring guide posts; but to all who have studied the fungi his researches have been a genuine stimulation." "It is one of the lessons of his life that the practical pursuit of botany is contributing to long life and glad heartiness."

"His work will stand for all time as the foundation upon which later students of the fungi may build with safety a more elaborate morphological and systematic revision of the fleshy and woody groups of fungi."

HUDSON FALLS, N. Y.

NOTES AND BRIEF ARTICLES

Professor John Dearness, one of the editors of MYCOLOGIA, was recently appointed principal of the Normal School at London, Ontario, Canada.

Dr. V. H. Young, formerly assistant professor of botany at the State University of Iowa, is now head of the department of botany at the University of Idaho.

Professor G. F. Atkinson,* with Miss Gertrude Douglass and Miss Edwina Smiley as assistants, spent most of the past summer between Florida and Washington, D. C., collecting and photographing fleshy fungi. About the middle of September he left for the Pacific Coast to continue the work of exploration.

Dr. Charlotte Elliott, of Dell Rapids, South Dakota, has been appointed assistant pathologist in the Laboratory of Plant Pathology, Bureau of Plant Industry.

Mr. G. H. Martin, Jr., formerly a teaching fellow in plant pathology at the University of Washington, has accepted the position of plant pathologist in the Plant Disease Survey, Bureau of Plant Industry.

Dr. F. A. Wolf, for several years in charge of the botany and plant pathology work at the North Carolina Agricultural College and Experiment Station, has been given a commission as first lieutenant in the sanitary corps of the Army.

The rare *Venenarius glabriceps,* figured in MYCOLOGIA for September, 1916, was found again in the New York Botanical Garden, on September 14, by F. F. Wilmousky.

* News has just been received that Professor Atkinson died of pneumonia in a hospital in Tacoma about the middle of November. Details are not available.

Excellent young specimens of *Armillaria nobilis* were recently sent to the Garden herbarium in a collection of 13 species of Colorado fungi secured by Dr. Joseph Cuneo at 8,500 feet elevation near Denver, Colorado.

Specimens of *Daedalea quercina* were collected in September at East Nottingham, Pennsylvania, by Professor A. H. Graves on Japanese chestnut and on butternut. The usual hosts for this fungus are oak and chestnut, butternut being very unusual.

A splendid sugar maple standing near the Bedford Park entrance to the Garden had one of its large branches torn away from the trunk several years ago by a storm, leaving an ugly wound. The entire side of the trunk below the wound is now covered with fruit-bodies of *Cerrena unicolor,* while *Elfvingia megaloma* appeared the past summer at the base of the tree.

Mrs. Wallis Craig Smith sent to the Garden herbarium late in September, from Upper Jay, New York, several interesting specimens of fleshy fungi, among them *Melanoleuca equestris, Melanoleuca Russula, Phylloporus rhodoxanthus,* and several specimens of a species of *Cortinarius* with the lamellae extremely abnormal, resembling the hymenium of a Merulius and suggesting *Tremella mycetophila.*

A new journal, the *Annals of the Phytopathological Society of Japan,* has been launched under the managership of N. Suemastu, T. Hemmi, and U. Bokura. The first number contains a brief historical sketch of the development of plant pathology in Japan; several papers on plant diseases; and thirty pages of reviews of pathological literature and notes. We welcome this new journal and wish for it great prosperity.

A very large collection of fungi was brought in on September 24 from Scarsdale, New York, by Mrs. I. Martin and Mrs. L. M. Keeler. It contained, in addition to many other interesting species, a specimen of *Grifola Sumstinei.* On September 25, Mrs. Keeler collected in the same locality a cluster of *Clitocybe sub-*

connexa and presented it to the Garden herbarium. This species was first collected in the New York Botanical Garden and had been known only from the original collection.

Grifola Sumstinei Murrill was collected three times last autumn in the vicinity of New York City. A splendid museum specimen was first sent in from Ridgewood, New Jersey, by Mrs. Alexander Taylor; and it was afterwards found at Princess Bay, Staten Island, by Mr. F. F. Wilmousky, and at Scarsdale by Mrs. L. M. Keeler. This large tree-destroying polypore is intermediate between *Grifola Berkeleyi* and *Grifola frondosa,* and would probably be confused by some with the latter species, but its lobes are broader and soon become blackish, both above and below.

Psilocybe polycephala (Paulet) Peck was collected by W. A. Murrill in his yard near Bronx Park on September 27, 1918. It had appeared in the same spot three consecutive seasons, growing in the grass among *Clitocybe multiceps.* The clusters are very dense and the small caps are yellowish-brown and very hygrophanous, becoming pallid on drying. According to Peck, the species is edible; its taste is certainly very agreeable. The gills are so slow in changing color that it might easily be mistaken at first for a white-spored species.

An article of unusual interest by Shantz and Piemeisel on fungous fairy rings in eastern Colorado and their effect on vegetation appeared in Vol. XI of the *Journal of Agricultural Research,* the 56 pages of text being illustrated by 21 plates and 15 figures. The paper begins with a summary of past studies and a list of the fungi that have been reported to form rings. Some are said to be destructive to grass and other forms of vegetation and others are claimed to be beneficial by causing stimulation of growth. The annual enlargement, as well as the age, of the rings is discussed, and some of the very large rings are estimated to be from 400 to 600 years old!

The North American species of *Coniophora* were treated by Burt in the *Annals of the Missouri Botanical Garden* for Septem-

ber, 1917. Dr. Burt recognizes 19 species, 5 of which are described as new and 2 are newly combined. The 33 pages of text are illustrated by 19 text figures. New species are: *Coniophora inflata*, from Parral, Mexico, *Matthews; C. vaga*, from Hudson Falls, New York, *Burnham; C. avellanea*, from East Galway, New York, *Burt; C. Harperi*, from Lake Geneva, Wisconsin, *Harper;* and *C. flava*, from Troy and Tyre, Jamaica, *Murrill & Harris*. New combinations are: *Coniophora Kalmiae* (Peck) Burt, and *C. polyporoidea* (Berk. & Curt.) Burt. The following species are excluded: *Coniophora capnoides* Ellis & Ev., *C. sordulenta* Cooke & Massee, and *Hypochnus pallescens* (Schw.) Burt, comb. nov.

A paper on some edible and poisonous mushrooms, by Dr. W. B. McDougall, was published in the spring of 1918 (Bull. Ill. State Lab. Nat. Hist. **11**: 413–555. 1917). The treatment of the species included is excellent, while the 57 halftone plates leave little to be desired except color. Attention may be called to the following species said to be edible: *Stropharia epimyces, Hypholoma lachrymabundum, Clitocybe odora, Mycena galericulata, Galera tenera, Claudopus nidulans*, and *Boletinus porosus*. The peculiar odor of *Claudopus nidulans*, so characteristic and yet so difficult to describe, is said to resemble that of the freshly opened viscera of swine. The parasitic mold so common on *Lentinus tigrinus* is said to be due to a species of *Sporotrichum*, a discovery credited to Miss Esther Young.

Dr. E. W. Olive, of the Brooklyn Botanic Garden, spent some time during the past summer assisting government and state agents in locating plant diseases and instructing farmers how to combat them. His experiences in parts of New York and Virginia were given in a public lecture at the New York Botanical Garden on October 26, with lantern slides illustrating some of the most important and recently introduced diseases, among them the nematode disease of wheat noted in the November number of MYCOLOGIA and the potato wart disease referred to below.

The European potato wart disease has been discovered in ten mining villages near Hazelton, Pennsylvania, by Professor J. G. Sanders, economic zoologist of that state. Every effort of the

state authorities, with the federal department assisting, is being directed to prevent the further spread of this insidious and most dangerous disease known to affect the potato. It appears that the disease has been established in some of these villages for at least seven or eight years, where it has been impossible at times to secure even the amount of seed planted. It is deemed advisable that all state authorities should inspect large centers of consumption where imported potatoes may have been purchased during the past eight or ten years.

A comprehensive report on the sugarcane diseases of Porto Rico, by J. R. Johnston and J. A. Stevenson, containing 88 pages of text and 13 plates, recently appeared in the *Journal of the Agricultural Department of Porto Rico*. It is stated that sugarcane diseases have been present and serious since 1870, and that some now present several difficult problems. Fungi found chiefly on the roots and lower stalk include *Marasmius Sacchari, Himantia stellifera,* and *Odontia saccharicola,* all of which are more or less concerned in the so-called root disease. The principal stalk diseases include red rot, *Colletotrichum falcatum;* rind disease, *Melanconium Sacchari;* and a new disease, *Cytospora Sacchari,* which seriously threatens certain varieties.

A number of leaf diseases are of universal occurrence, though none appear to be seriously injurious. Descriptions are given of red spot of the leaf sheath, *Cercospora vaginae;* red rot of the leaf sheath, *Sclerotium Rolfsii;* eye spot, *Helminthosporium Sacchari;* ring spot, *Leptosphaeria Sacchari;* brown leaf spot, *Cercospora longipes;* red stripe; and wither tip. The only important disease of cane cuttings, which is that due to *Thielaviopsis paradoxa,* is readily prevented by dipping them in Bordeaux mixture.

A chlorotic disease occurring on the south coast is described in connection with control measures. Yellow stripe occurs in very limited areas. The new disease (as yet uncontrolled), which is characterized by a mottling of the leaves followed by a stalk canker, occurs in the western portion of the island, occasioning heavy losses.

The influence of the war on botany is discussed in *Science* for August 23, 1918, by Neil E. Stevens, who finds that the "most striking effect on American botanists has been to direct their attention more generally than ever before to the problems of plant pathology. . . . Statements that we 'must save wheat for our allies' lent new interest to the fact that stinking smut of wheat annually costs the United States twenty-two million bushels. Urgent advice that we must use perishable fruits and vegetables to save more concentrated foods for the armies in France called public attention sharply to the fact that fresh fruits and vegetables cannot easily be shipped great distances, that they are in truth highly perishable; and finally to the tragic fact that large amounts are annually lost in transit and on the market. . . . This summer is seeing a campaign for the control of plant diseases never approached in this country. With this there is being carried on an increased amount of research on fundamental scientific questions of significance in the control of plant diseases. . . . Undoubtedly the greatest immediate gain will come from the extension work, from the distribution of information to the plant pathologists of every state in the union and the further distribution of this information through the county agents and the farm demonstrators to the actual producers. It is highly probable, however, that the greatest ultimate good to plant pathology as a science and to the nation will come from the temporary enlistment of a large number of botanists from other lines."

Dr. Burt has done an excellent piece of work on the genus *Merulius* as represented in North America. His treatment was published in the *Annals of the Missouri Botanical Garden* for November, 1917, and comprises 58 pages of text, 38 text figures, and 3 plates containing 36 figures photographed natural size. There are 40 species recognized, 15 of which are new, 3 newly combined, and 2 doubtful and excluded. Most of the Garden collection was studied by Dr. Burt and 5 of his types are in the Garden herbarium.

New species: *Merulius hirsutus,* from Jalapa, Mexico, *Murrill; M. cubensis,* from Alto Cedro, Cuba, *Earle & Murrill; M. gyrosus,* from Vermilion, Michigan, *Povah; M. sororius,* from Ta-

koma Park, Maryland, *Shear; M. lichenicola,* from North Elba, New York, *Peck; M. dubius,* from New York City, *Murrill; M. sulphureus,* from Palm Beach, Florida, *Thaxter; M. tomentosus,* from Sidney, British Columbia, *Macoun; M. hirtellus,* from Sharon, Massachusetts, *Piquet; M. Farlowii,* from Chocorua, New Hampshire, *Farlow; M. americanus; M. hexagonoides,* from Muir Woods, California, *Harper; M. montanus,* from Priest River, Idaho, *Weir; M. byssoideus,* from Rio Piedras, Porto Rico, *Johnston;* and *M. atrovirens,* from Mt. Mitchell, North Carolina, *Atkinson.*

New combinations: *Merulius deglubens* (Berk. & Curt.) Burt, *M. terrestris* (Peck) Burt, and *M. pinastri* (Fries) Burt.

Doubtful and excluded species: *Merulius patellaeformis* Berk. & Curt. and *Poria incrassata* (Berk. & Curt.) Burt, comb. nov.

Merulius hirsutus was described by Dr. Burt from only a fragment of the original collection, owing to a delay in sending him the two large collections made near Jalapa, Mexico, one of which was accompanied by field notes and a colored sketch. In spite of this, the description as published leaves little to be desired. Dr. Murrill's field notes, however, are added below:

Pileus imbricate, sessile, projecting 1–4 cm., 3–5 cm. broad, about 3 mm. thick; surface cottony-white and densely tomentose, white on the margin; hymenium uneven and somewhat zonate-sulcate, ochraceous to ferruginous, consisting of very obtuse, low folds, which disappear near the margin.

On fallen dead branches in the forest.

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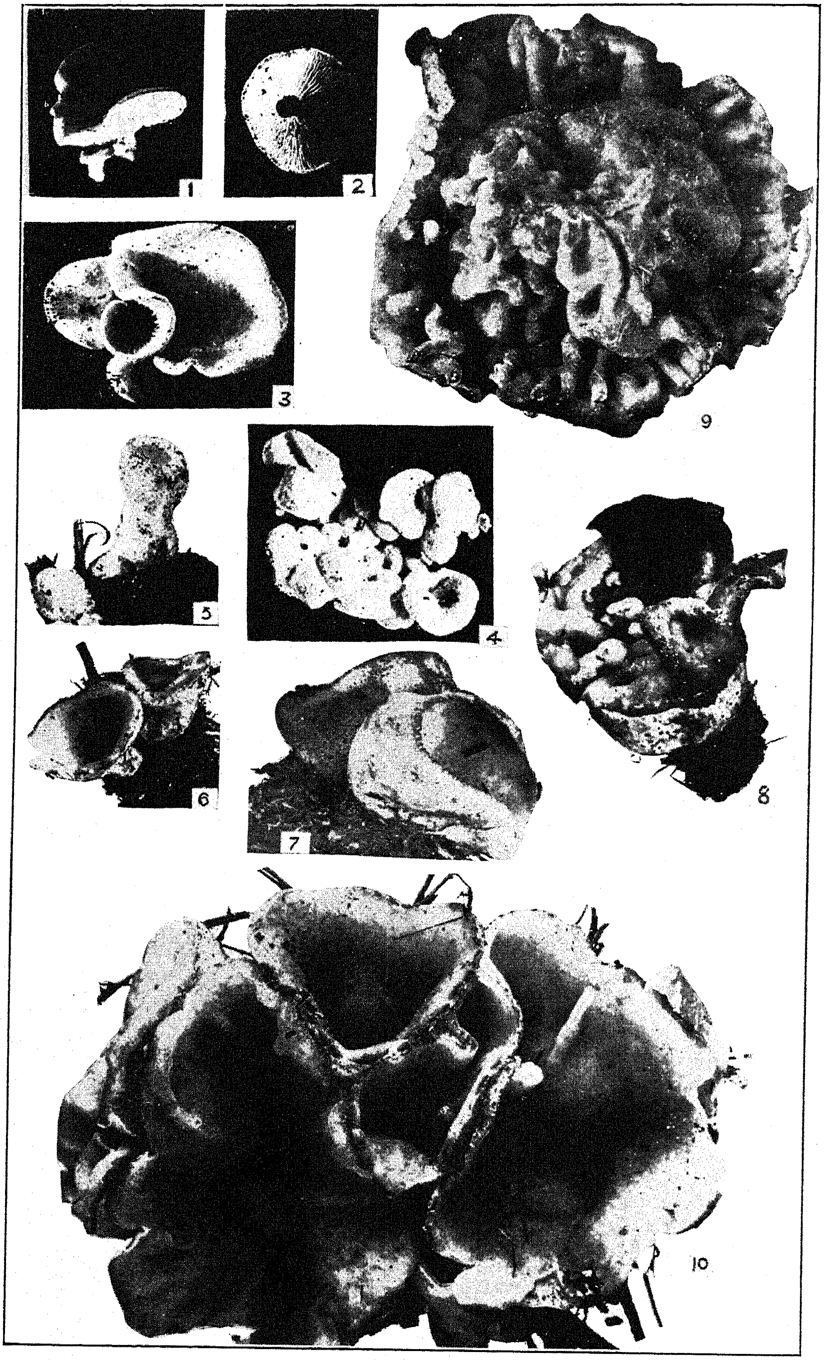

FUNGI APPEARING IN MUSHROOM BEDS

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FURTHER NOTES ON THE SPORADIC APPEARANCE OF NON-EDIBLE MUSHROOMS IN CULTIVATED MUSHROOM BEDS

Michael Levine

(With Plate 4)

To the student of fleshy fungi the winter season can be used to great advantage in collecting and studying the Agarics and different forms of Pezizas which appear in cutlivated mushroom beds. In a previous paper[1] I pointed out that a number of agarics appear besides *Agaricus campestris* in cultivated mushroom beds and that in a number of cases rather uncommon mushrooms are found which appear to be confined to the mushroom house or appear but rarely outside of mushroom culture beds. At present the fungus *Panaeolus venenosus* Murrill;[2] interesting for its toxicological properties, is known only from mushroom beds in which the cultivated mushroom is grown. In the present note I wish further to add to the list of names of fungi which may be found in mushroom houses.

In the spring season of 1918, in New York, there commonly appeared in beds well illuminated, somewhat dry, and shortly after casing, a great number of small white mushrooms which at first glance gives one the impression of seeing large spots of white felt covering the soil. On closer examination it is found that the

[1] Levine, M. The sporadic appearance of non-edible mushrooms in culture of *Agaricus campestris*. Bull. Torr. Club. Feb., 1919.

[2] ——. The physiological properties of two species of poisonous mushrooms. Mem. Torr. Club 17: 176–201. *pls. 1–2.* 1918.

[Mycologia for January (11: 1–50) was issued December 21, 1918.]

white masses are due to great numbers of fused pilei which have relatively short stipes (see Figs. 1–4).

Further study shows that the plants are sometimes isolated, growing singly and centrally stiped as shown in figures 1 and 2, but these are not very common; more often the plants are laterally stiped and cespitose.

The individual plant varies in size from .25 cm. to 2 cm. in diameter and the height is about 1/5 to 1/4 of the size of the diameter. The pileus is white and when fresh is covered by a very delicate and uneven tomentum. The pileus in the cespitose forms is umbonate but when it is centrally stiped, the disk is markedly depressed. The margin is incurved, thin, and irregular, and very often sinuous (Figure 3). When old the surface is smooth, white, and very faintly cream-colored. The stipe is white and short and has a tendency to taper upwards; very often it is lacking. The stipe generally remains white even when it is dry.

The gills are white when fresh but become decidedly cream-colored like the pileus when dry; slightly sinuate, adnate with a decurrent tooth; medium distant. When these plants are soaked in water shortly after drying they assume their natural color and consistency, which is more or less leathery. Their taste is pleasant and not unlike that of *Agaricus campestris*.

The spores are hyaline and ovoid in shape, measuring from $3.3\,\mu$–$4.4\,\mu \times 6.6\,\mu$–$11\,\mu$ and form a spore print which is white. These plants were submitted to Dr. W. A. Murrill for identification, who regards them as a new species of no well determined genus. It is possible that these plants are dwarfed specimens of *Clitocybe dealbata,* but the great difference in size precludes their being regarded as typical of the species, although they may be closely related to it. It must be remembered that a number of varieties of this species have been reported. I am not prepared, however, to say that this is a new variety of *C. dealbata;* it certainly differs from all *C. dealbata* varieties so far described by Peck.[3]

Specimens of this fungus have been deposited with Dr. W. A. Murrill at the New York Botanical Garden.

[3] Peck, C. H. New York State Museum Bull. 157: 67–68, 73, 1911.

ALEURIA VESICULOSA BULL. AND ALEURIA VESICULOSA BULL. VAR. SACCATA FR.

Other fungi, which appeared in the mushroom houses around New York about the same time, are shown in figures 5 to 10. These plants appeared in the manure of newly made mushroom beds. They were particularly abundant near the boards which enclosed the beds made under the benches in a greenhouse. The plants appeared in great clusters weighing from ½ to 2 lbs.

These plants are typical mushroom cellar plants and have been described and figured by Boudier.[4]

Aleuria vesiculosa var. *saccata* is identical with *Aleuria vesiculosa* except for the hymenial surface, which in the former is cerebriform as shown in figures 8 and 9. The spores also are slightly different in size. In the early stages no difference could be detected between them. The plants at this stage (Figures 5 and 6) are covered with a whitish-gray papillate structure which disappears as the plants grow older, although the color of the outer surface always remains lighter than the hymenium, which is buff-brown in color. Great numbers of plants in this stage appeared without showing any indication of a cerebriform hymenium, although at slightly older stages shown in figures 7 and 8 the two forms can readily be distinguished. It has been assumed that the manure and the soil used for casing are responsible for the sporadic appearance of the non-edible mushrooms in the mushroom cellars; up to the present however no conclusive evidence has been brought to bear on this subject and it may be suggested that the so-called "Pure Spawn" is not beyond suspicion.

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EXPLANATION OF PLATE 4

FIGS. 1, 2, 3, 4. Show the nature of the pileus, stipe, gills and general habit of fungus described in text. (Natural size.)

FIGS. 5, 6. Young stages in the development of *Aleuria vesiculosa* Bull. (Natural size.)

[4] Boudier, E. Icones Mycologicae 2: pl. 257–258. 4: p. 139.

FIG. 7. Older stage in the development of *Aleuria vesiculosa* Bull. (Natural size.)

FIG. 8. Slightly older stage in the development of *Aleuria vesiculosa* Bull. var. *saccata* Fr. (Size × ½.)

FIG. 9. Mature plant of *Aleuria vesiculosa* Bull. var. *saccata* Fr. (Size × ½.)

FIG. 10. A cluster of cups of *Aleuria vesiculosa*. (Size × ¼.)

AN UNDESCRIBED SPECIES OF OPHIODOTHELLA ON FICUS

Ernst A. Bessey

(With Plate 5)

The fungus herein described was collected repeatedly by the writer in the vicinity of Miami, Florida, in 1907 and 1908. It was recognized as an apparently undescribed Dothideaceous fungus, but until the appearance of the monograph on that group by Theissen and Sydow its generic position, even, could not be determined.

Ophiodothella Fici sp. nov.[1]

The stromata are 1 to 10 mm. in diameter, scattered irregularly or sometimes grouped concentrically, extending from the upper to the lower surface of the leaf, shining-black on the lower surface, usually long covered by the wrinkled remains of the epidermis and cuticle on the upper surface, which give it a whitish appearance. This coat disappears in old specimens and is often ruptured irregularly or pierced by the ostioles of the pycnidial cavities. The leaf is much thickened. Normally it is about 450 μ thick but the diseased spots may be 650 to 860 μ in thickness.

Three layers may be distinguished in the stroma: (1) between the upper epidermis and the palisade cells, usually destroying the inner two layers of the mostly three-layered epidermis, about 100 to 180 μ thick, light-colored and thinner near the edges and very dark and thicker toward the center, especially in proximity to the pycnidial cavities. The two-layered palisade parenchyma occupies about 100 to 120 μ, and is little modified except that the lower ends of the inner cells appear to be destroyed, and that here and there several cells of both rows are destroyed to make room for a mass of light-colored, stromatic hyphae to connect the

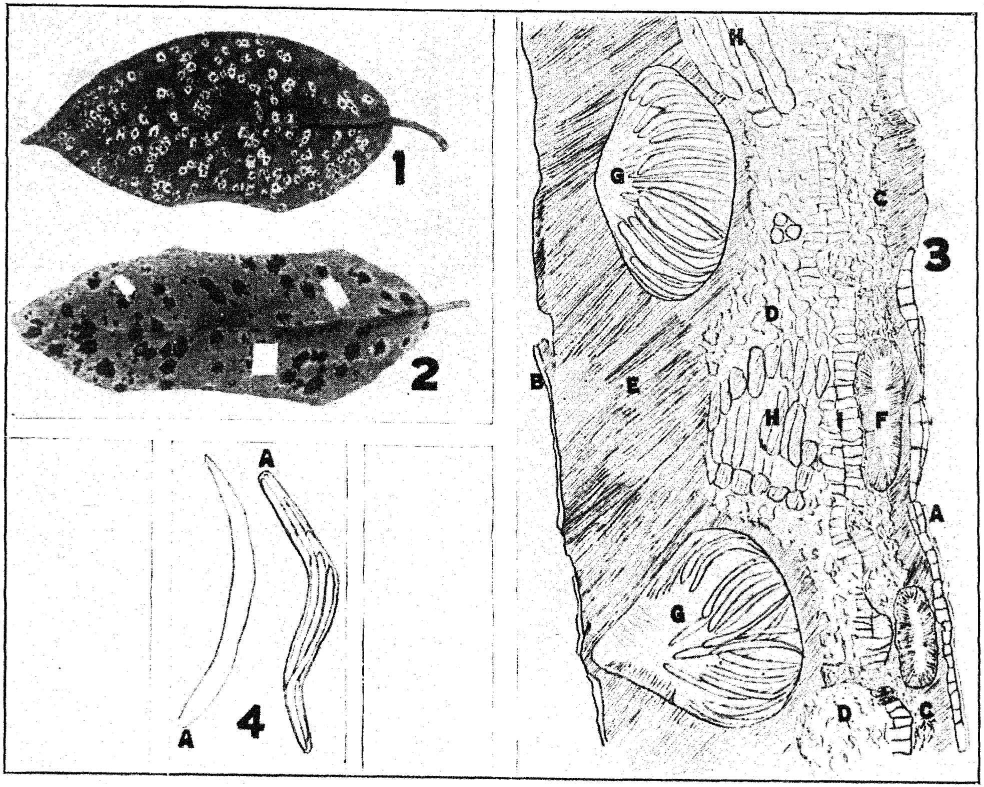
1 Specimens of this species are in the collection of the New York Botanical Garden under the manuscript name of *Ophiodothis Fici* Earle. The species has also been collected in Cuba.

upper stromatic layer with the second one (2) which occupies most of the region normally filled by the spongy parenchyma. The latter is entirely destroyed or one may find a few disconnected cells here and there throughout the loose white stromatic structure which is 150 to 300 μ thick. This grades rather abruptly into (3) the lower stromatic mass which is dense and black and occupies the under side of the leaf to the utter destruction of the tissues, even the epidermis being destroyed except bits of the cuticle here and there, or near the edge of the spot. This layer is 210 to 230 μ thick.

The perithecia are few or many, depending upon the size of the stroma. They lie in the lower stroma, projecting upward into the loose, white middle stroma. In this latter the hyphae are darker and more densely crowded about the perithecial cavity. The perithecia are 400 to 450 μ high and 300 to 500 μ in diameter. The ostioles are only very slightly papillate. The basal portions of the perithecia appear on cross section of the leaf to be free, but in reality they are bound together by the loose mass of the colorless hyphae making up the middle stromatic layer. Their apical portions are connected by the lower stromatic layer almost as a sort of clypeus. There is no distinct perithecial wall. The very numerous asci arise in the basal portion of the perithecium and are elongate-fusiform, 105–175 $\times$ 12–16 μ, tapering gradually to the base and somewhat more abruptly to the rounded apex.

Between the asci are found occasional slender, filiform, septate (?) paraphyses which equal the asci in length. These are very numerous around the edge of the mass of asci and line the walls of the upper portion of the perithecial cavity. The eight ascospores are filiform, 77–87 $\times$ 4.7–6.2 μ, dilutely brown, very granular, the color residing in the granules, with a clear spot (vacuole ?) about 5 μ in length at the middle of the spore. They are not septate. Toward either end of the ascus they lie singly or doubly, but are in double or triple rows towards the middle. They taper more toward the lower end, being very slightly clavate. They are straight, or curved slightly at the smaller end.

In the younger spots before the perithecia appear, but persisting even until the maturity of the latter, there appear in the upper



OPHIODOTHELLA FICI BESSEY

stromatic layer a few to several pycnidial cavities which are at first without ostioles. They are 180 to 300 μ in diameter and about 75–100 μ thick in a vertical direction. They are lined on all sides by the very short conidiophores. The conidia are elongate, usually curved, rarely hooked, and slightly clavate, 12–19 $\times$ 1 μ, non-septate, and hyaline or very dilutely brown when examined singly. When the infected leaves are placed in a damp-chamber the conidia ooze out in a worm-like mass, very dark brown or even shining-black in color, to the naked eye, and fusco-ferruginous under the lower magnifications of the microscope.

The single stromata or groups of stromata occupy yellowish-green spots on the leaves, with ferruginous margins. When abundantly infected the whole leaf takes on a yellowish color, contrasting strongly with the black stromata. Such leaves fall prematurely in great numbers.

On the leaves of *Ficus aurea* near Larkins, Dade Co., Florida, Oct. 31, 1907 (type), and January 15, 1908, and at Little River, November 12, 1907, as well as occasionally at other places in the vicinity of Miami, Florida. Type deposited in the Mycological Herbarium of the Bureau of Plant Industry, U. S. Department of Agriculture.

This fungus belongs without doubt in the vicinity of the genus Ophiodothella as limited by Theissen and Sydow, but has paraphyses in the perithecia, while these authors describe the genus as aparaphysate. Furthermore, none of the hitherto recognized species of this genus possess a pycnidial stage such as has the present species. However, these points do not seem to warrant the erection of a new genus.

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EXPLANATION OF PLATE 5

FIG. 1. Leaf of *Ficus aurea* affected by *Ophiodothella Fici,* upper surface.

FIG. 2. Ditto, lower surface.

FIG. 3. Section of stroma: (*A*) remains of upper epidermis, (*B*) remains of lower cuticle, (*C*) upper stromatic layer, (*D*) middle stromatic layer, (*E*) lower stromatic layer, (*F*) pycnidium, (*G*) perithecium, (*H*) vascular bundle, (*I*) palisade layer. The outlines of this sketch were made with the aid of a camera lucida.

FIG. 4. Asci, one showing ascospores in outline; (*A*) apical end.

CONCERNING THE INTRODUCTION INTO THE UNITED STATES OF EXTRA-LIMITAL WOOD-DESTROYING FUNGI

James R. Weir

Introduction

A recent study of a number of tropical wood-destroying fungi which grow on species of trees, the wood of which, either in a manufactured or unmanufactured state, is imported into the United States, raises a question which may well receive attention from foresters and dealers in structural timbers. Our plant quarantine laws provide for a close scrutiny of a great variety of plant material, but no one has given much thought to the possibility of the introduction into this country of wood-destroying fungi on imported timbers.

That fungi may be transmitted to distant parts of the country by the living mycelium in the wood of structural timber in initial stages of decay, is well known. A few examples in the writer's experience are illuminating. At Portland, Oregon, on a white oak timber which had come originally from Ohio, the sporophores of *Stereum frustulosum* Fr. were found. This fungus has never been reported from the West, and in this case was certainly carried in the diseased timber. It could be easily introduced into western hardwood forests by this means. At Bellingham, Washington, in August, 1916, two species of wood-destroying fungi not native to this country were collected from old timbers stacked on the harbor wharves. The timbers were practically rotted and evidently had been used in temporary structure work in vessels. These two species, viz., *Polystictus Persoonii* Fr. and *Trametes atypus* Lév. (*T. aurora* Ces., *T. paleacea*), are common in all tropical and semi-tropical countries, especially in Japan and the Philippines. Several collections of the latter species from the Philippines, in the writer's herbarium, show that it grows on some

of the most valuable timber trees of that region, and evidently causes a serious rot. It has also been observed that in one case square timbers showed incipient or initial decay by fungi not known to occur in the foreign country to which the timbers were shipped. The ease with which lumber may become infected, while stored in insanitary yards, is only another example of how wood-destroying fungi may be transported from one country to another.

DISTRIBUTION OF WOOD-DESTROYING FUNGI

In contrast to the higher plants, many of the wood-destroying fungi are widely distributed throughout the world. For example, *Fontes annosus* Fr., *Fomes* (*Trametes*) *Pini* (Brot.) Lloyd, and *Armillaria mellea* (Vahl.), three of the most destructive forest tree fungi in America and Europe, are reported from various tropical countries. In the latter regions these species are apparently not abundant, a condition which is difficult to explain. On the other hand, there are a number of serious wood-destroyers and parasitic species which are confined to the tropics or to foreign countries in general. There is no reason why these species should not find a favorable environment in some of the varied climates of the United States, if once introduced. It is well known that in the case of some parasitic fungi a change from one country to another of different climatic conditions may often be favorable to the fungus, which may develop into a serious pest. This could be true of many foreign wood-destroying fungi.

POSSIBLE EXPLANATIONS FOR THE APPARENT SMALL NUMBER OF WOOD-DESTROYING FUNGI IN THE TROPICS

Contrary to the general opinion and as compared to the conditions in the temperate zones, the number of species of this group in the tropics may not be considered particularly abundant. Westerdijk[1] explains this condition through the assumption that in the tropics "the heavy rainfalls, combined with the abundant transpiration—owing to the intense heat, must cause a high water-

[1] Westerdijk, Johanna. Phytopathology in the Tropics. Ann. Mo. Bot. Gard. 2: 308. 1915.

content and a small air-content, of the wood-vessels of the trees, thereby making a substratum poor in air. . . ."

The assumption that an abundant transpiration may cause a high water content in the tissues is in direct contradiction to the latest research on the subject. Dixon[2] demonstrated that the transpiration pull during the growing season tends to reduce the water content of the plant, hence the gas content is increased. That the gas content in the wood is an important factor influencing the entrance of the mycelium and its subsequent spread has been experimentally determined by Münch.[3] More recently Zeller[4] showed that any factor influencing the proportion of water and air in the substratum is of great importance.

A factor which would apparently retard the development of wood-destroying fungi in the wood-vessels of trees growing in the tropics is the absence of any marked periodicity in wood formation. Naturally the vital processes in tropical vegetation have a rhythmical alternation of periods of rest and activity, determined usually by a wet and dry season, but the latter period is short and no such contrast between large and small vessels is produced as in temperate zones. This condition of almost continuous growth in contrast to the alternating periods of rest and growth in colder climates may tend to retard the spread of mycelium in the wood. This is reasonable to suppose, in view of the fact that in the temperate zone wood-destroying fungi are more active during the dormant period of their hosts. Continuous growth, or unimportant temperate changes, may either one conceivably result in decreased air content, and the mycelium would have difficulty in finding the proper balance between air and moisture in the wood. The great density of most tropical woods would also be a factor in this respect. Again, it is conceivable that the soil solutions in the tropics, being warmer and therefore less able to hold gas in solution, contain less oxygen than in tem-

[2] Dixon, H. H. Transpiration and the ascent of sap in plants. Macmillan & Co. 1914.

[3] Münch, E. Untersuchungen über Immunität und Krankheitsempfänglichkeit der Holspflanzen. Naturwiss. Zeitschr. f. Forst. u. Landw. 7: 54–75, 87–114, 129–160. 1909.

[4] Zeller, S. M. Studies in the physiology of the fungi. II. *Lenzites saepiaria* Fr., with special reference to enzyme activity. Ann. of Mo. Bot. Gard. 3: 448–449. 1916.

perate regions. This high temperature and consequent low gas solubility, resulting in a deficiency of dissolved oxygen in soil solutions and therefore in cell sap, might make tropical wood less aërated. Abundant decaying organic matter resulting in a soil solution with a low oxygen and a high carbon dioxide content might possibly produce a cell sap with the same unfavorable gas content. There is also a possibility of the heartwood of trees remaining functional for a longer period than is the case in temperate zones. This would reduce the gas content and prevent the advance of the mycelium in the wood. This condition is analogous to the observed behavior of mycelia of wood-destroying fungi in the wood of resinous and non-resinous conifers, or in the wood of broad-leaved species forming or not forming heartwood. In trees with a pronounced heartwood, decay is usually very pronounced, in contrast to those where the central cylinder remains for a longer time functional; that is, transporting soil solutions to the crown. There are exceptions to this generalization. The heartwood of birch, which remains functional for a longer time than that of oak, is seriously rotted by *Fomes ignarius* (Gill). The non-resinous heartwood of *Abies grandis* is uniformly rotted by *Echinodontium tinctorium* E. and E. Undoubtedly the requirements of fungi differ to the extent that whereas one species may find the non-resinous heartwood of *Abies,* for example, favorable, as in the case of *Echinodontium,* the fungus will not develop in the wood of pine or larch. In the case of *Abies* and *Echinodontium* we may assume that the gas present in the heartwood of the host may be of a higher oxygen ratio than is the case in those trees which it will not attack. To understand the particular conditions which govern the relations of host and fungus is a problem for the future, and is of great practical importance.

TROPICAL WOOD-DESTROYING FUNGI IN THE TEMPERATE ZONE

The reason for contrasting the conditions of growth between the tropics and temperate zones is by way of introduction to the idea that the wound fungi[5] of tropical or foreign timber trees

[5] In the writer's opinion the term "wound parasite" as it is ordinarily employed is misleading. The parasitism of but few wood-destroying fungi

would find favorable conditions for growth on our native species. It is to be assumed, of course, that our native forest trees, at least in some regions, would be susceptible to attack. It may also be assumed that the tropical fungi have built up strong parasitic tendencies in order to counteract continuous growth in their exogenous and endogenous growing hosts, which would tend to make them more vigorous and destructive when growing under reverse conditions. Of course, all of this is pure conjecture, for our knowledge as to how fungi endemic in tropical and foreign countries would react to the low temperature of a more temperate climate, is very limited. Unless their food requirements are at variance with that which they would find in our native trees, the lower temperature can be expected to stimulate growth. The average temperature for the growth of wood-destroying fungi is comparatively low. Falck[6] has shown that the growth range for a number of wood-destroying fungi lies between 3° and 44° C., with an optimum temperature between 18° and 35° C. Humphrey[7] states that "for the majority of species the most favorable temperature lies between 75° and 85° F." This author further states that out of a series of some 50 species tested none would grow above 118° F., and in general wood-destroying fungi are much less tolerant of high temperatures than low ones, while temperatures slightly above the freezing point will usually permit some growth. This writer found that on storing a large number of stock cultures of different species in an ice box where the

has been investigated. The mere fact that they are found growing from wounds does not imply that they would attack the living cell. *Fomes pinicola,* one of the most common saprophytes, chiefly on coniferous wood, not infrequently enters through wounds and destroys the heartwood of living trees, but it would not be considered parasitic. Some such term as *wound fungus* would be more conservative, and would merely imply that the fungus grew on the dead wood of wounds or entered the heartwood in this manner.

6 Falck, Richard. Wachstumgesetze, Wachstumfaktoren und Temperaturwerte der hölzzerstörenden Mycelien. In Moller, Alfred. Hausschwammforschungen. Heft 1, p. 53–154. 1907.

——. Die Lenzitesfäule des Coniferenholzes, eine auf kultureller Grundlage bearbeitete Monographie der Coniferenholz bewohnenden Lenzites-Arten. In Möller, Alfred. Hausschwammforschungen. Heft 3, 234 pp. 24 fig., 7 pl. 1909.

7 Humphrey. Timber decay and its growing importance. Railway Age Gazette, p. 10. Dec. 15, 1916.

temperatures vary around 40° to 60° F., several species grew luxuriantly. It is known that the coldest weather in northern climates is not sufficient to destroy the vitality of sporophores of tree fungi, in fact Buller[8] has shown that certain species will withstand the temperature of liquid air (—190 deg.) for protracted periods. Westerdijk[9] advances the view that the tropical temperature is too high for many fungi, and states that in her laboratory over 600 fungi are cultivated, and this collection shows cleary that the temperature of optimum growth of the greater part of the fungi lies below 30° C., often under 25° C. An exposure to high temperature prevents many parasites from forming their spores or fruiting bodies, whereas others require a change of temperature for normal growth. The Polyporaceae, for instance, bear exposure to frost very well, but many of them scarcely develop at 30° C. That the low winter temperatures of northern climates will not affect the vitality of at least some tropical wood-destroying fungi is shown by the following experiment. During the winter of 1909, the writer took a section of a tree branch on which were two or three small sporophores of *Polystictus sanguineus* Fr. from the mycological collection at the University of Munich, and placed it on the ground in the forest among other branches of native Alnus bearing sporophores of *Polystictus hirsutus* Fr. The branch had been in the collection about two years and had been collected in the low lands of Brazil. Very early in the following spring, while snow was still on the ground, the sporophores of the native fungus started growing. A week later the tripical species revived, and before the end of spring not only had produced a new hymenium but enlarged its hymenial surface to about one fourth of its original size, and one entirely new but small sporophore was produced. Sporophores of *Polystictus occidentalis* (Klotzsch) and *P. maxima* (Mont.) from the warm zones of Cuba attached to their substrata were exposed to

8 Buller. Upon the vitality by dried fruiting bodies of certain Hymenomycetes, including an account of an experiment with liquid air. Trans. of the British Mycological Society, 112. 1912.

Also Buller and Cameron. On the temporary suspension of vitality in the fruit bodies of certain Hymenomycetes. Trans. of the Royal Soc. of Canada. Third Ser. **6**: 73–75. 1912.

9 Westerdijk, Johanna. Loc. cit. 1.

the winter weather of Missoula, Mont. (—30° Fahr.). In late spring these plants revived and produced new fertile spore surfaces. These experiments not only illustrate the xerophytic nature of the group[10] to which they belong, but demonstrate the fact that at least some tropical wood-destroying fungi will, no doubt, find suitable conditions of growth in regions farther north. It may be expected, of course, that the change in environment will affect certain morphological changes in the fruiting structure. Indeed the question may be asked, why not regard *Polystictus sanguineus* identical with *P. cinnabarinus* Jacq. This response to change in environment may be observed in any of our native species in its range from warmer and drier regions to the damp cold forests of the north, or when observed at different elevations on high mountains.[11]

As already indicated, there is always the danger of a fungus, irrespective of the part of the world from which it may come, finding a more favorable environment when introduced into new regions. The history of many of our plant disease epidemics in this country during the past few years illustrates this fully. It is possible that certain of our common wound fungi may have developed parasitic tendencies due to great difficulties to be overcome, as has previously been indicated, and may be of some economic importance in this country. For example, *Fomes applanatus* Pers., found in the heartwood of a variety of trees, is not known to be a parasite in this country. The writer has specimens of this fungus from Peru, with the statement that it attacks the roots of fruit trees and does considerable damage. This would lead one to think that it would be unsafe to introduce this particular strain (if it may be so called) or this species into this country.

Not until investigations in forest pathology in tropical lands have reached as high a plane as they have in temperate zones will we know what we may fall heir to from foreign countries. With the increase in commercial intercourse with foreign lands and the increased demands for the timbers and other plant life they pro-

[10] Buller. Loc. cit. 8.

[11] Weir, Jas. R. Notes on the altitudinal range of forest fungi. MYCOLOGIA, 10: p. 4–14. 1918.

duce, it is reasonable to suppose that we may expect wood-destroying fungi to find their way into this country. It would seem a wise plan to make a careful study of the agents of decay directly in the field where they grow. This would yield a knowledge of the fungous diseases in the uncultivated forests of exporting countries, and our inspectors could then do their work more intelligently.

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INDEX TO AMERICAN SPECIES OF PHYLLOSTICTA

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In "The North American Phyllostictas" Ellis and Everhart brought together descriptions of all the species of this genus reported from North America up to 1900. About 225 species were included. During the eighteen years which have elapsed since the publication of that excellent monograph 41 new species have been described from America north of Mexico, 20 other described species have been reported for the first time, 116 new hosts have been added, transfers have been made to and from the genus, *Ascomycete* connections have been established for a few and various changes in names of species and hosts have been proposed. There is no one place in the literature where these changes have been recorded and the genus brought up to date. Saccardo lists only a few of the new species. Having found a *Phyllosticta* on a host new to himself, the collector at once turns to Ellis and Everhart. If he fails to find it there, he is confronted with the prospect of spending many hours, or even days, searching through a staggering array of periodicals to see whether it has been described. Even if he finds it in "The North American Phillostictas" he wonders how many changes it has undergone since 1900. His difficulties are not diminished by the changes in names of the host plants since Ellis and Everhart wrote.

Having had this discouraging experience a few times in working with *Phyllosticta,* the writer finally resorted to a card index in which he has listed the new species, hosts and various changes with citations, and which he uses as a supplement to the previously mentioned monograph. It is published here with the thought that others also may find it useful in saving many tedious hours spent in combing the numberless periodicals, etc., in which a description or report of an American species may be hidden away.

The species are first listed alphabetically with citations of litera-

ture and occasional explanatory notes. For convenience in reference they are numbered serially beginning with 228, the next number after the last in "The North American Phyllostictas." Species which have been described as new from American plants since 1900 are indicated by bold face type in the citation. The compartively few species reported from tropical America, viz., Central America, Mexico and the West Indies, are not included.

The host index which follows includes all species on which Phyllostictas have been reported, both those in Ellis and Everhart's monograph and those subsequently reported. The names of all hosts have been made to conform with the Seventh Edition of Gray's Manual of Botany except for those which occur beyond the field of the Manual.

Doubtless, a closer scrutiny of the species and comparative examination of type material will show that some of the species in this list are synonyms. But the present paper is not presented as a critical review of the genus. It is merely a ready finding index by which the collector may quickly find the literature on the *Phyllostictae* which occur on a host and then draw his own conclusions. The numbers used in the host index refer to the numbered species in "The North American Phyllostictas" and to the numbers used in the alphabetical supplementary list here given.

ALPHABETICAL LIST OF SPECIES[1]

[1] In order to conserve space the following abbreviations are used: M. = Mycologia; J. M. = Journal of Mycology; A. M. = Annales Mycologici; B. = Bulletin; R. = Report; N. Y. Mus. B. = Bulletin of the New York State Museum; N. A. Ph. = The North American Phyllostictas; B. Tor. B. C. = Bulletin of the Torrey Botanical Club. Other periodicals are abbreviated in the usual way so that there will probably be no difficulty in understanding them.

228 *Alcides* Sacc. var. *americana* Sacc. & D. Sacc., on *Populus alba* Syl. 18: 240. = *P. Alcides* E. & K. O. Nat. 2: 223. 1902.

229 *Ampelopsidis* E. & M. (N. A. Ph. 71) = *Guignardia Bidwelli* (Ell.) Viala & Ravaz. See N. Y. (Cornell) B. 293: 307 for synonymy.

230 *Antirrhini* Syd., on *Antirrhinum majus* in Mass. This species has not previously been reported from America unless it is identical with the Phoma reported by Stewart on this host. N. Y. (Geneva) B. 179: 109. 1900.

231 *apicalis* Davis, on *Salix lucida* in Wis. **Wis. Ac. Sci. 16 (II): 761. 1909.**

232 *Apocyni* Trel. (N. A. Ph. 132), on *Apocynum androsaemifolia* in N. Y. N. Y. Mus. B. 188: 49. 1916. New host.

233 *arida* Earle, on *Acer Negundo* in Ala. **B. Tor. B. C. 25: 367.** 1898.

234 *Atriplicis* Desm., on *Atriplex hastata* in Pa. M. **6**: 33. 1914. Author believes this is either a Macrophoma or a Septoria. Reported on *Chenopodium album.* M. **8**: 176. 1916. Also on *C. album* in Wis. Ac. Sci. 17 (II): 865. 1914.

235 *Baccharidis* Dearn. & House, on *Baccharis halimifolia* in N. Y. **N. Y. Mus. B. 179: 29.** 1915.

236 *Betae* Oudem., on *Beta vulgaris.* = *Phoma Betae.* J. M. 10: 2. 1904. = *P. tabifica.* Impf. of *Mycosphaerella tabifica* (P. & D.) Johns.? (Cf. Stevens' Fungi which cause plant diseases, p. 247.)

237 *bicolor* Pk., on *Rubus odoratus* in N. Y. **N. Y. Mus. R.** 43: 72. 1890.

238 *biformis* Heald & Wolf, on *Diospyros texana* in Texas. **M.** 3: 7. 1911.

239 *brassicicola* McA., on *Brassica oleracea* in Calif. Impf. of *Mycosphaerella brassicicola* (Duby) Lin. Phytopath. 5: 263. 1915.

240 *brumeliifolia* Heald & Wolf, on *Brumellia lanuginosa* in Tex. **M.** 3: 7. 1911.

241 *brunnea* Dearn. & Barth., on *Populus angustifolia* in Col. **M. 9: 351.** 1917.

242 *canescens* E. & E. (N. A. Ph. 67), on *Ribes divaricatum* in Idaho. B. Tor. Bot. Cl. 27: 54. 1900.

243 *caricicola* Sacc. & Scalia, on *Carex sp.* in Alaska. **Alas. Har. Exp. 5: 21.** 1904.

244 *Caricis* (Fckl.) Sacc. (N. A. Ph. 218), on *Carex trisperma* and *C. intumescens* in Wis. Wis. Ac. Sci. 17 (II): 865. 1914.

245 *Cephalanthi* Tharp, on *Cephalanthus occidentalis* in Tex. **M. 9: 119.** 1917.

246 *Chenopodii* Sacc., on *Chenopodium album* in N. Y. N. Y. Mus. B. 179: 29. 1915.

247 *circumscissa* Cke. (N. A. Ph. 44), on *Prunus persica* in N. Y. Tor. 14: 210. 1914. The host is not given in N. A. Ph. but the reference is to exsiccati on *Prunus demissa.*

248 *clypeata* E. & E., on *Pyrus Malus* in Ore. **J. M. 8: 14.** 1902.

249 *Collinsoniae* Sacc. & Dearn., on *Collinsonia canadensis* in Ont. **A. M. 12: 299.** 1914.

250 *congesta* Heald & Wolf on *Prunus* in Tex. **M. 3: 8.** 1911.

251 *convexula* Bubak on *Carya alba* in Mo. **J. M. 12: 62.** 1906.

252 *Crataegi* (Cke.) Sacc. (N. A. Ph. 82), on *Crataegus erythropoda* in N. M. M. 10: 253. 1918. On *C. Holmesiana* in N. Y. N. Y. Mus. B. 197: 49. 1918. New hosts.

253 *crataegicola* Sacc., on *Crataegus mollis* in N. D. M. 10: 218. 1918.

254 *cruenta* (Fr.) Kicks. (N. A. Ph. 215), on *Smilicina stellata* in N. D. M. 10: 218. 1918. On *S. amplexicaulis* in N. M. M. **8**: 176. 1916. New hosts and change in authority for binomial.

255 *cruenta* var. *discincta* Davis on *Uvularia grandiflora* and *Oakesia sessilifolia* in Wis. **Wis. Ac. Sci.** 16 **(II): 761.** 1909. Also 17 **(II): 867.** 1914.

256 *cucurbitacearum* Sacc., on *Cucumis sativa* and *C. melo* in Ohio. O. B. 214: 394. Reported from various other states.

257 *Dearnessii* Sacc., on *Rubus triflorus* in Ont. **A. M. 11: 549.** 1913.

258 *decidua* E. & K. (N. A. Ph. 201), on *Radicula Armoracia, Geum canadense, Aralia racemosa, Steironema ciliatum, Cynoglossum officinale, Lappula virginiana, Scutellaria laterifolia, Nepeta hederacea, Stachys palustris, S. tenuifolia, Monarda punctata, Lycopus uniflorus, Mentha arvensis canadensis, Eupatorium perfoliatum, Bidens frondosa, Lactuca canadensis* and *Hieracium aurantiacum* in Wis. Wis. Ac. Sci. **17** (II): 867. 1914 and **18 (I): 258.** 1915. New hosts. Vernonia, listed in N. A. Ph., is evidently a mistake for Veronica.

259 *destruens* Desm. (N. A. Ph. 40), on *Prunus melanocarpa* in N. D. M. **10**: 218. 1918. Identical with *Phoma virginiana* E. & Hals. acc. to Davis. Wis. Ac. Sci. **18** (I): 79. 1915. New host.

260 *Dictamni* Fairm., on *Dictamnus Fraxinella* in N. Y. **A. M. 8: 324.** 1910.

261 *Diervillae* Davis, on *Diervilla Lonicera* in Wis. **Wis. Ac. Sci. 16 (II): 761.** 1909.

262 *Digitalis* Bell, on Digitalis in N. Y. Tor. **14**: 210. 1914. On *D. purpurea* in Ont. A. M. 11: 549. 1913.

263 *Euonymi* Tharp, on *Euonymus atropurpureus* in Tex. **M. 9: 119.** 1917.

264 *fragaricola* Desm. & Rob., on *Fragaria grandiflora* in Ont. A. M. 11: 549. 1913.

265 *fraxinicola* (Curr.) Sacc. emended. J. M. **13**: 51. 1907.

266 *Garrettii* Syd., on *Senecio disparis* in Utah. **A. M. 6: 484.** 1908.

267 *grisea* Pk., on *Crataegus praecox* in N. Y. **N. Y. Mus. B. 67: 29.** 1903.

268 *helliboricola* var. *Coptidis* Sacc. & Scalia, on *Coptis trifoliata* in Alaska. **Alas. Har. Exp. 5: 21.** 1904.

269 *hortorum* Speg. (N. A. Ph. 167), on *Solanum melongenum* (cult.) in Wis. Wis. Ac. Sci. **17** (II): 867. 1914. New host.

270 *innumerabilis* Pk., on Amelanchier in Nebr. **B. Tor. Cl. 36:** 336. 1909.

271 *ivaecola* E. & E. (N. A. Ph. 12), on *Iva xanthiifolia* in N. D. M. **10**: 218. 1918. New host.

272 *juliflora* E. & B., on pods of *Prosopis juliflora* in Tex. **J. M. 8: 174.** 1902.

273 *kalmicola* Schw. var. *berolinensiformis* Fairm., on *Kalmia latifolia* in N. Y. **A. M. 8: 324.** 1910.

274 *labruscae* Thuem. (N. A. Ph. 71), on *Vitis vulpina* in Iowa. M. **1**: 269. On *Psedera quinquefolia* in N. D. M. **10**: 218. 1918. Various other states. On *Ps. tricuspidata* in N. Y. Tor. **14**: 210. 1914. On *P. vitacea* in Wis. Wis. Ac. Sci. **17** (II): 866. 1914. New hosts. Imperf. of *Guignardia Bidwellii* (Ell.) Viala & Ravaz. For full synonymy see N. Y. (Cor.) B. 293: 307.

275 *lantanoidis* Pk. (N. A. Ph. 94), on *Viburnum cassinoides* in N. Y. N. Y. Mus. B. 179: 29. 1915. New host.

276 *Liatridis* Davis, on *Liatris spicata* in Wis. **Wis. Ac. Sci. 18 (I): 87.** 1915.

277 *Liriodendri* Cke., emended. J. M. 13: 51. 1907.

278 *livida* E. & E. (N. A. Ph. 49), on *Quercus macrocarpa* in Wis. Wis. Ac. Sci. 18 (I): 87. 1915. New host.

279 *macroguttata* Earle, on *Desmodium Dillenii* and *D. sp.* in Ala. **B. Tor. B. C. 25: 367.** 1898.

280 *maculicola* Hals., on Dracaena in N. J. **N. J. R. 14: 355.** 1893.

281 *maculiformis* Sacc., on *Alnus rugosa* in N. Y. N. Y. Mus. B. 197: 49. Impf. of *Mycosphaerella maculiformis* (Pers.) Schr.

282 *mahoniaecola* Pass., on Mahonia in N. Y. N. Y. Mus. B. 167: 30. 1912.

283 *Medeolae* Dearn. & House, on *Medeola virginiana* in N. Y. **N. Y. Mus. B. 179: 29.** 1915.

284 *minima* (B. & C.) E. & E. (N. A. Ph. 1), on *Acer saccharum, A. saccharinum* and *A. spicatum.* Wis. Ac. Sci. 17 (II): 866 and 18 (I): 258. 1914 and 1915. New hosts.

285 *Mulgedii* Davis, on *Lactuca leucophaea* in Wis. **Wis. Ac. Sci. 16 (II): 761.** 1909. Davis later decided that this was probably a Phoma. Wis. Ac. 18 (I): 79. 1915.

286 *Myricae* Cke. (N. A. Ph. 72), on *Myrica carolinensis* in N. Y. N. Y. Mus. B. 188: 38. 1916. New host.

287 *nebulosa* Sacc., on *Silene noctiflora* in Wis. Wis. Ac. Sc. 17 (II): 865. 1914.

288 *Oakesiae* Dearn. & House, on *Uvularia* (*Oakesia*) *sessilifolia* in N. Y. **N. Y. Mus. B. 179: 30.** 1915.

289 *obscurans* (E. & E.) Fl. Tassi. Bul. Lab. ed. Orto Bot. Siena 5: 13. 1902. First described by Ellis & Everhart as *Phoma obscurans* on Fragaria (cult.) in Va. Proc. Phil. Acad. 1894: 357.

290 *orobella* Sacc., on *Lathyrus maritimus* in N. Y. N. Y. Mus. B. 179: 30. 1915.

291 *Oxalidis* Sacc., on *Oxalis stricta* in Wis. Wis. Ac. Sci. 17 (II): 866. 1914.

292 *Pachysandrae* Dearn. & House, on *Pachysandra procumbens* in N. C. **N. Y. Mus. B. 179: 35.** 1915.

293 *Padi* Brun, on *Prunus virginiana* in Canada. A. M. 11: 549. 1913.

294 *pallidior* Pk., on *Smilacina stellata* in N. Y. **N. Y. Mus. B. 105: 26.** 1905. = *P. cruenta* (Fr.) Kicks. var. *pallidior* (Pk.) Davis on *S. racemosa* and *S. stellata* in Wis. Wis. Ac. Sc. 17 (II): 865. 1914.

295 *paupercula* Pk., on *Amelanchier alnifolia* in Kans. **N. Y. Mus. B. 150: 60.** 1911.

296 *Paviae* Desm. (N. A. Ph. 122), = *Guignardia Aesculi* (Pk.) Stewart. Phytopath. 6: 5. 1916. *P. aesculicola* Sacc. (N. A. Ph. 123) regarded by Stewart as the spermagonial stage of the same species.

297 *phomiformis* Sacc. (N. A. Ph. 56) on *Quercus Prinus* and *Q. prinoides* in N. Y. N. Y. Mus. B. 188: 50. On *Q. bicolor* in Wis. Wis. Ac. Sci. 18 (I): 258. 1915. New hosts.

298 *pirina* Sacc. = *Coniothyrium pirina* (Sacc.) Sheldon. Torreya, July, 1907. See also Sci. (II) 36: 155–157. 1912.

299 *Pitcheriana* Fairm., on *Heliopsis Pitcheriana* (cult.) in N. Y. A. M. 8: 324. 1910.

300 *prunicola* Sacc. (N. A. Ph. 45), on *Prunus nigra* in Wis. Wis. Ac. Sc. 17 (II): 866. 1914. New host.

301 *Psoraleae* (Cke.) Fl. Tassi, on Psoralea. Described as *Phoma Psoralea* Cke. Bul. Lab. ed Orto Bot. Siena 5: 13. 1902.

302 *putrifaciens* Shear, on *Vaccinium macrocarpum* in N. J. **B. Tor. B. Cl. 34: 307.** 1907.

303 *Quercus* Sacc. & Speg., on *Quercus alba* and *Q. macrocarpa* in Wis. Wis. Ac. Sc. 17 (II): 865. 1914.

304 *raui* (Pk.) Dearn. & House, on *Artemisia scopulorum* in Col. N. Y. Mus. B. 179: 36. 1915. Synonymy given. Previously called Sphaeropsis by Peck.

305 *renouana* Sacc. and Roum., on *Typha latifolia* in Wis. Wis. Ac. Sc. 17 (II): 864. 1914.

306 *Rhexiae* Dearn. & House, on *Rhexia ciliosa* in Fla. **N. Y. Mus. B. 179: 35.** 1915.

307 *Richardsoniae* E. & E., on *Richardsonia scabra* in Ala. **J. M. 8: 62.** 1902.

308 *Sassafras* Cke., emended, J. M. 13: 53. 1907.

309 *sicyna* Sacc., on *Sicyos angulatus* in N. Y. **A. M. 10: 343.** 1908.

310 *smilicina* (Pk.) Dearn., should replace *P. Smilacis* E. & M. (N. A. Ph. 221) M. 9: 351. 1917. Full synonymy given. On *Smilax rotundifolia* in N. Y. Torreya 14: 210. 1914.

311 *solitaria* E. & E. (N. A. Ph. 104), on *Pyrus Malus* throughout the central states. Sci. (II) 26: 183. 1907. New host. The specific name given in N. A. Ph. is evidently incorrectly spelled.

312 *Steironematis* Dearn. & House, on *Steironema ciliatum* in N. Y. **N. Y. Mus. B. 188: 38.** 1916.

313 *subtilis* Pk., on *Carya* in N. Y. **N. Y. Mus. B. 150: 36.** 1911.

314 *Syriaca* Sacc., on *Hibiscus syriacus* in N. Y. J. M. 13: 69. 1907.

315 *Syringae* West, on *Syringa vulgaris* in Wis. Wis. Ac. Sc. 17 (II): 867. 1914.

316 *tabifica* Prill. See *P. Betae*.

317 *tineola* Sacc. on *Viburnum pubescens* in Wis. Wis. Ac. Sc. 17 (II): 867. 1914.

318 *Trillii* E. & E. (N. A. Ph. 146), on *Trillium cernum* in Wis. Wis. Ac. Sc. 17 (II): 865. 1914. New host.

319 *typhina* Sacc. on Typha in N. Y. J. M. 13: 69. 1907.

320 *verbenicola* Tharp, on *Verbena bipinnatifida* in Tex. **M. 9: 120.** 1917. This specific name is untenable because previously used, cf. *P. verbenicola* Martin, J. M. 2: 26. 1886.

321 *Verbesinae* Heald & Wolf, on *Verbesina texana* in Tex. **M. 3: 8.** 1911.

322 *virginiana* (Ell. & Hals.) Fl. Tassi. The correct name for *Phoma virginiana* E. & H. Bul. Lab. ed Orto Bot. Siena 5: 13. 1902.

323 *Medicaginis* Fckl. on alfalfa in the central states. Impf. of *Pyrenopeziza Medicaginis* Fckl. Phytopath. 6: 102. 1916.

324 *straminella* Bres., on rhubarb, *Rheum Rhaponticum*, in Ind. and Ills. Ills. Exp. Sta. B. 213. 1919.

HOST INDEX OF ALL SPECIES REPORTED FROM NORTH AMERICA

AMHERST, MASSACHUSETTS,
January, 1919.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—VI

Tyôzaburô Tanaka

Uncinula curvispora K. Hara sp. nov. (in litt.).

Uncinula septata Salm. var. *curvispora* K. Hara var. nov. in Dainippon Sanrin Kwaihô (Journ. Forestry Asso. Japan) Tôkyô, 392: 62. T. 4, vii Jul. 1915. (Japanese.)

Spots obsolete, hypophyllous; mycelia spreading in thin film-like overgrowth, fugacious; perithecia punctiform, scattered, flat-discoidal or conspicuously compressed into scale form, 170–220 μ (aver. 200 μ) diam., black; perithecial wall membranaceous, cells small and irregular, sometimes more or less radiating, 4–8 μ wide; appendages numerous, 200–300 altogether, filiform, simple, smooth, thin-walled, 35–200 μ long, 4–11 septate throughout, the basal half yellowish-brown, 6–7 μ across, gradually narrowed toward the apex, 2–2.5 μ across near the hyaline ends, apex coiled spirally; asci 3–5 to one perithecium, ellipsoid or ovoid, rounded at the apex, beaked, below, walls rather thick but brittle, 65–75 × 37–50 μ; ascospores 4–5, ellipsoid, ovoid, or ovoid-reniform, both ends rounded, yellowish, unicellular, granular inside, 28–35 × 12–15 rarely 45 × 18 μ.

On *Fagus sylvatica* var. *Sieboldi.*

Locality and distribution: Not given.

Notes: In a letter from Mr. Hara, received shortly before by the writer, a very peculiar habit of this fungus is described, which caused him to determine to raise this as a species. He found that the perithecia at maturity behaved always to turn over on their heads holding the substratum with their appendages exactly like the perithecia of *Phyllactinia corylea* do with the second appendages. He proposes a new subgenus *Asterothecia* to which the species belong, characterized by another noteworthy peculiar form of flattened perithecia.

Uncinula geniculata Gerard var. *carpinicola* K. Hara var. nov. in Dainippon Sanrin Kwaihô (Journ. Forestry Assoc. Japan) Tôkyô, no. 392, p. 62, 63, 1 text fig. on p. 64 (to the right) T. 4, vii, Jul. 1915. (Japanese.)

Amphigenous; mycelia persistent or evanescent, thin, filmy; hyphae filamentous, colorless, branching, septate, 3–4 μ across; perithecia gregarious or scattered, spheroid or depressed-spheroid, 70–100 μ diam.; perithecial walls membranaceous, dark-brown, composed of cells 10–18 μ wide; appendages 16–20 altogether, delicate, filiform, straight or infiexed about the middle, continuous, glabrous, equally thickened, spirally helicoid at the apex, 150–440 × 6–7 μ; asci 6–8 in one perithecium, ellipsoid or ovoid, unicellular, hyaline, one or two nucleate at the middle, 15–20 × 9–11 μ.

On *Carpinus* sp.

Locality and distribution: Not given.

Figures (woodcut) give the shape of appendages.

Differs from the type by having (1) amphigenous and much smaller perithecia, (2) very long appendages measuring 1.5 to 4 times as long as the perithecium and in numbers and dimensions of asci and ascospores.

UNCINULA NECATOR (Schw.) Burr. var. *Actinidiae* K. Hara comb. nov. in Dainippon Sanrin Kwaihô (Journ. Forestry Assoc. Japan) Tôkyô, no. 392, p. 63–64, 1 text fig. on p. 64 (middle). T. 4, vii, Jul. 1915. (Japanese.)

U. Actinidiae Miyabe ex Salm. Monogr. Eris. 101. 1900 (nom. nud.).

Spots amphigenous, white or cinereous, irregular, somewhat pulverulent; mycelia thin, effused, persistent or evanescent; hyphae filamentous, branched, septate, 3–4 μ diam.; perithecia amphigenous, scattered or gregarious, spheroid or complanate-spheroid, 80–120 μ, average 100 μ diam.; cells forming perithecial wall 10–20 μ, rarely 23 μ wide, dark-brown; appendages 10–23, linear, simple or rarely forked, 3–7 septate or continuous, colorless above, usually 6–8 μ across, strongly helicoid at the apex, swollen at the base with diam. 9–13 μ, total length 100–250 μ, commonly, 200 μ; asci 4–6, ovoid, ellipsoid or spheroid, beakless or occasionally beaked, 50–60 × 35–40 μ, spherical ones 50 μ diam.; ascospores 4–6, hyaline, ellipsoid or ovoid, 18–23 × 10–13 μ.

On *Actinidia polygama* and *Actinidia Kolomikta*.

Locality and distribution: Not given.

Illustrations (woodcut) gives appendages, ascus, and ascospores. In comparison, several appendages of *U. necator* from wine grape are figured to the left hand.

Note: Salmon states that the occurrence of this fungus on *Actinidia* in Japan suggests that native locality of grape mildew disease in the Orient (Monogr. Erisiph. 1900, p. 101), but Hara considers there is evidently a considerable morphological difference between this and the typical *U. necator,* the former being characterized by short, stout, subrigid appendages, with distinct swollen bases, and by typically beakless asci.

MICROSPHAERA ALNI (Wallr.) Salm. forma Quercus-glanduliferae K. Hara forma nov. in Dainippon Sanrin Kwaihô (Journ. Forestry Assoc. Japan) Tôkyô, **392**: 64 Jul. 1015. (Japaneses.)

Appendages once branch dichotomously about the middle. Other characters same as type.

On *Quercus glandulifera.*

Locality and distribution not given.

MACROPHOMA CORCHORI Sawada sp. nov. in Taiwan Nôjihô (Formosan Agric. Review) Taihoku, 120: 868–871. T. 5, xi, Nov. 1916. (Japanese.)

Spots indefinite; mycelia corticolous or lignicolous, occasionally formed in medulla, colorless; hyphae aseptate, branching, 3–8 μ across, freely passing through the host cells; pycnidia subepidermal, punctiform, black, with ostiola erumpent, spheroid, depressed-spheroid or ovoid, often sub-confluent, 98–225 $\times$ 89–275 μ; cells forming perithecial wall multiserial, black; ostiola with round openings 15 μ in diam.; conidiophores numerous, densely coarctate, cylindric, somewhat tapering toward the apex, simple, straight or slightly curved, continuous, hyaline, 10–14 $\times$ 2.5–3.5 μ, terminated by a single pycnospore; pycnospores ovoid-oblong, oblong-ellipsoid or short-clavate, rounded at the apex, obsuse at the base, straight or slightly curved, smooth, unicellular, finely guttulate, hyaline, 16–32 $\times$ 7–10 μ.

On *Corchorus capsularis* (jute).

Locality: Formosa (widely distributed).

Notes: The diseases of jute have not yet been well studied by pathologists even though the plant is so important as a source of textile fiber. Sawada states that this dieback disease is one of the most devastating jute diseases in Formosa and the annual loss is sometimes recorded as 30–40 % of the total crop. The only remedy for this is said to be to avoid an insufficient supply of potash in the soil, and Bordeaux mixture was shown to be no protection against the disease.

Sawada gives (on p. 864) five more species of fungi attacking the jute plant in Formosa, among which two are new, that is, *Phyllosticta Corchori* Sawada sp. nov., *Hymenula nigra* Sawada sp. nov., *Hypochnus centrifugus* (Lév.) Tul., *Sphaeroptheca fuliginea* (Schlecht) Pollacci, and *Rhizoctonia Solani* Kuehn.

PERONOSPORA CHENOPODII-FICIFOLII Sawada sp. nov. in Taiwan, Sôtokufu Nôji Shikenjô (Agr. Exp. Sta. Formosa) Circular. Publication No. 101, p. 9–10, 15, figs. 6–10, June, 1916 (Japanese): in Taiwan Nôjihô (The Formosan Agr. Review) No. 155, p. 29, 32, figs. 6–10. June 20, 1916. (Japanese.)

Hypophyllous, forming a pale-purplish-gray growth on the under surface of leaves, discoloration rather prominent, pale-yellow, round or irregular, about 1–27 mm. in diam., sometimes covering entire under surface; hyphae intercellular, colorless, aseptate, 7–12 μ across haustoria simple or branched at the tips, mostly more or less spiral, 10–20 $\times$ 3–4 μ; conidiospores caespitose from stromata, 240–500 $\times$ 8–14 4μ, 3–6-rarely 7-times dichotomously branching, all branches extremely curved, average of main stem and branches first to fifth orders measuring respectively 310.4 $\times$ 10.5, 33.9 $\times$ 6.5, 27.6 $\times$ 5.9, 24.1 $\times$ 4.5, 16.4 $\times$ 3.8, and 10.2 $\times$ 3.4 μ; conidia oblong or somewhat ellipsoid, papillate at the basal ends, fuliginous or cinereous, 26–36 $\times$ 17–25 (average 30.6 $\times$ 20.9), germinate with germ tubes; germ tubes not conspicuously swollen at the base, 4–7 μ.

Oögonial stage not known.

On *Chenopodium ficifolium*, parasitic, Taiwan (Formosa), common.

PERONOSPORA EFFUSA (Grev.) Ces. var. *minor* Casp.) on *Spinacia oleracea* (spinach: Hôrensô in Japanese) and *Peronospora Chenopodii* Casp. (=*p. effusa* var. *major* Casp.) on *Chenopodium album* are also studied, and inoculation experiments proved the independence of all of these three species. Morphologically, this species differs from *P. effusa* in having (1) spots more intensely colored, (2) hyphae in host tissues thicker with more or less spiral haustoria, (3) curved branches of conidiophore much longer in every respect, (4) papillate conidia more intensely colored, and much longer, (5) germ tubes not conspicuously swollen at the base; from *P. chenopodii* in having (1) more loose and less branching conidiophores, the main stems of which appear more slender, (2) conidia much longer, mostly oblong.

The present idea regarding the omnivorous nature of peronosporaceous fungi will have to be greatly altered, as is proved in this case by inoculation experiments which show an entire lack of relationship among species occurring on closely related host plants, even growing in the same field. Sawada also succeeded in making the following three independent species from what has been known as the lettuce downy mildew fungus, *Bremia Lactucae,* which attacks 66 species belonging to 24 genera so far as has been described.

(1) BREMIA SONCHI K. Sawada sp. nov. in Shokubutsugaku Zasshi (Botan. Magaz.) Tôkyô, 28^{326}: 80–83. Text fig. 2. Feb., 1914. (Japanese.)

Foliicolous or caulicolous; spots small, polygonal, rarely cover entire surface in lower leaves; aërial hyphae usually scanty, arachnoid when appearing on lower leaves; intercellular hyphae hyaline, continuous, finally granulate, 8–17 μ; haustoria spherical, occasionally obovoid or subclavate, $11–24 \times 7–13\,\mu$ conidiophores caespitous from stomata, whole length 230–560 μ, upper half 3–6 times dichotomously branching, the dimension of main stem, and branches of first to fourth orders respectively measuring 286×9, 74×8, 65×6, 52×4, $43 \times 3.5\,\mu$, basal portion of main stem somewhat swelling, each branch rather slender, curved, rarely 1-septate throughout the conidiophore, swellings of terminal branches spherical, 2–6 sterigmate, sterigmata $4–7 \times 2.5–3\,\mu$, terminated by single standing conidia; conidia mostly globose, occasionally obovoid, flat-papillate above, small-pedicellate below, containing protoplasm highly reflecting light, $17–24 \times 13–21\,\mu$, germinate in 2 hours; germ tubes 3.5–6 μ diam., varying in thickness through the growth.

On *Sonchus oleraceus.*

Locality: Taiwan (Formosa). Common.

Illustration: One woodcut figure showing conidiophore, haustoria and conidia.

Inoculation result is only positive on above plant, negative on *Crepis japonica, Lactuca debilis, Lactuca laciniata, Lactuca scariola* var. *sativa* (Lettuce), *Arctium Lappa, Hemistepta carthamoides, Sonchus oleraceus,* and *Taraxacum platycarpum.*

Chief morphological difference from *B. Lactucae* lies in (1) the situation of lowest branch of conidiophore nearly at the

middle, not at one-third or one-fifth of the whole length as in *B. Lactucae*, (2) the form of disk of terminal branches of conidiophore nearly spherical instead of disk-shaped.

(2) BREMIA SAUSSUREAE Sawada sp. nov. l. c. p. 80–83. Text fig. 2.

Foliicolous; spots pale-yellowish, polygonal, about 15 mm. broad, forming a dense white growth on the under surface of leaves; intercellular hypae running through mesophyll tissues, granulate, 8–17 μ across; haustoria ovoid, obovoid, or irregular, 14–27 × 5–14 μ; conidiophore single or caespitose from stomata, very long, 270–1021 μ, 3–6 dichotomously branching, branches all short and stout, the dimension of main stem and branches of first to fourth orders measuring respectively 622 × 10, 57 × 8, 37 × 7, 28 × 5, 18 × 4 μ, septate (usually 5–6), swellings of terminal branches 4–6 sterigmate, sterigmata 6–10 × 3 μ, terminated by single standing conidia; conidia conspicuously large, broadly ellipsoid to elongate-oblong, flat-papillate above, pedicellate below, granulate, 24–57 × 18–28 μ, hyaline, germinate in 2 hours, germ tubes 4.5–7 μ across, not uniform in diameter.

On *Hemistepta carthamoides* (=*Saussurea affinis* not Spreng.).

Locality: Taiwan (Formosa). Common.

Illustration: One woodcut text figure showing conidiophore, conidia, and haustoria.

Inoculation experiment negative on *Crepis japonica, Sanchus oleraceus, Lactuca debilis, Lactuca scariola* var. *sativa, Lactuca laciniata, Arctium Lappa,* and *Taraxacum platycarpum.*

(3) BREMIA OVATA Sawada sp. nov. l. c. p. 83–84. Text fig. 3.

Hyphae 7 μ across; conidiophores caespitose, total length almost 1 mm., 3–8 times dichotomously branching, usually 7–8 septate, main stem comparatively long, branches short, average dimension of main stem and branches of first to fifth orders measuring respectively 591 × 8, 55 × 6, 52 × 5, 44 × 3.5, 24 × 3, 13 × 3 μ; swelling a terminal branch spherical or top-shaped, 3–7 sterigmate; sterigma 6–8 μ long; conidia ovoid or oblong-ovoid, minutely pedicellate below, apical papilla obsolete, 14–18 × 10–13 μ, hyaline, granulate, germinate with germ tubes; germ tubes 3.5–4 μ across, nearly uniform in thickness.

On *Crepis japonica,* occurring with *Protomyces Inonyei* P. Henn.

Locality: Taiwan (Formosa). Rare.

Illustration: One woodcut text figure showing conidiophore and conidia.

Sufficient material was not secured to make inoculation experiments. The species is characterized by the very short terminal branch of the conidiophore, the long main stem, ovoid conidia, and uniform growth of germ tubes.

HELICOBASIDIDUM MOMPA N. Tanaka forma *macrosporum* K. Hara form. nov. in Dainippon Sanshi Kwaihô (Journ. Seric. Assoc. Japan) Tôkyô. **26**^{308}: 725. T. 6. ix. Sept., 1917. (Japanese.)

Sporidia oblong-ovoid, straight or curved, rounded at the apex, gradually pointing toward the base, $15\text{–}25 \times 6\text{–}8\,\mu$, average $18 \times 7\,\mu$.

On *Morus*.

Locality: Not given.

This form is to be distinguished from the typical "Mompa" fungus, which has much smaller sporidia, measuring $10\text{–}15 \times 5\text{–}7\,\mu$. (N. Tanaka, in Journ. Coll. Sci., Tôkyô. 4^1: 194. 1891.)

On account of the absence of protobasidia, the species belongs to *Helicobasidium* instead of to *Septobasidium*, to which it was transferred by Raciborski in 1909 (Bull. Int. Ac. Sci. Cracovie; Math.-Nat., Ann. 1909: 365).

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

A SMUT ON IRESINE

John A. Elliott

Among some specimens of insect-gall material collected by Mr. Chas. C. Dean in Indiana and sent to Dr. B. W. Wells of the

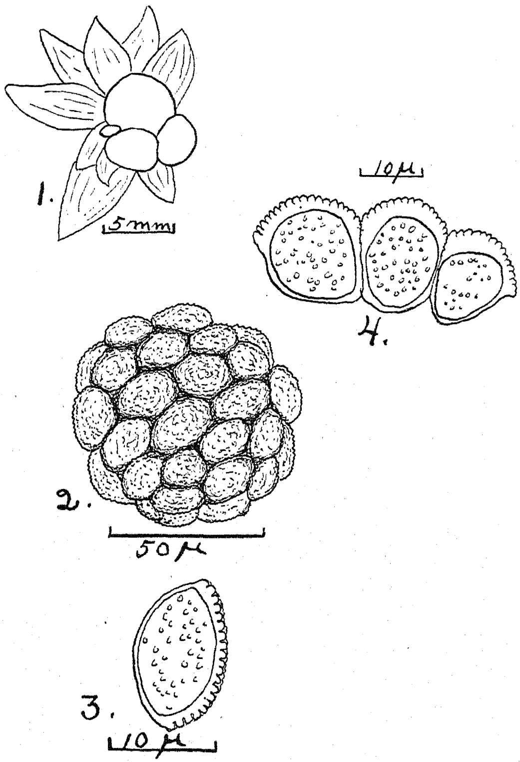

FIG. 1. *Tolyposporium iresine* sori in ovaries of *Iresine paniculata.* FIG. 2. Spore-ball of *T. iresine.* FIG. 3. Single spore of *T. iresine.* FIG. 4. Three united spores of *T. iresine.*

University of Arkansas for identification, was a very interesting smut affecting the ovaries of *Iresine paniculata* (L.) Ktze. In response to an inquiry, Miss Vera K. Charles reported that no

record of a smut on *Iresine* or any of its near relatives could be found in the host index of the Bureau of Plant Industry.

According to Clinton's key in *North American Flora,* the smut belongs in the genus *Tolyposporium,* but no species described by Clinton fits the smut found on *Iresine,* which is therefore described here as new.

As southern Indiana approaches the northern limit of *Iresine paniculata,* it was thought that the smut might be found in Arkansas, where the plant is a very common weed. No specimens of the smut could be found here, however, in the limited search made during the past season, and so far the smut is known only from the place where it was collected by Mr. Dean.

Tolyposporium iresine sp. nov.

Sori in ovaries, infecting all the ovaries of a flower, sparingly scattered throughout the inflorescence, subglobose to globose, 1–5 mm. in diameter, covered with a gray-green, rather tough membrane which on rupturing discloses the granular spore-mass; spore-balls olive-brown, translucent to nearly opaque, subspherical to spherical, firm, composed of from 15–75 spores, 32–70 μ in length, mostly about 60 μ; spores olive-brown, subspherical, lens-shaped, to irregular depending on compression due to surrounding cells, adhering in a hollow ball by folds of their outer thickened, rugose membrane, which may entirely separate from some of the cells on rupturing, 12–20 μ in diameter.

On *Iresine paniculata,* Posey County, Indiana. Collected by Chas. C. Dean, Sept. 21, 1918. Flora of Indiana, No. 26, 651. Known only from the type locality.

UNIVERSITY OF ARKANSAS,
FAYETTEVILLE, ARKANSAS.

NOTES AND BRIEF ARTICLES

Professor J. C. Arthur, one of the editors of MYCOLOGIA and a large contributor both to it and *North American Flora,* was elected President of the Botanical Society of America at the recent meeting in Baltimore.

Mr. James Birch Rorer is now Mycologist of the Associacion de Agricultores del Ecuador, with headquarters at Guayaquil.

Dr. Charles T. Gregory, formerly assistant professor of plant pathology at Cornell University, has entered the Bureau of Plant Industry as extension pathologist in Truck and Forage Crop Diseases for the State of Indiana, with headquarters at Purdue University.

Mr. W. H. Tisdale, formerly scientific assistant in cereal disease investigations, Bureau of Plant Industry, has become the head of the department of botany and plant pathology in the North Carolina College of Agriculture.

Dr. George M. Reed has resigned his position as professor of botany in the University of Missouri to take up work on the smuts of cereals as a pathologist of the Bureau of Plant Industry.

Mr. J. H. Muncie, formerly assistant in plant pathology at the Michigan Agricultural Experiment Station and recently pathologist with the Plant Disease Survey, Bureau of Plant Industry, has accepted the position of pathologist at the new field laboratory of the Pennsylvania Agricultural Experiment Station at Girard, Pennsylvania.

Dr. A. G. Johnson, associate professor of plant pathology at the University of Wisconsin, has accepted an appointment as pathologist in cereal disease investigations, Bureau of Plant Industry.

Dr. V. B. Stewart died of pneumonia on December 3, aged thirty years. He held a research position as assistant professor of plant pathology at Cornell University for five years, during which time he made numerous contributions to his science. The most notable of these concern diseases of horticultural and ornamental nursery stock. On July 1 last he became pathological adviser to the eastern market inspectors of the U. S. Department of Agriculture. This work had to do particularly with detecting incipient disease in shipments of perishable plant products intended for the army and navy. Exposure in the performance of this duty led to the fatal attack.

The Phytopathologists at their recent meeting in Baltimore voted enthusiastically to continue the various kinds of war work begun during the past two years. Dr. C. L. Shear was elected president of the society for the coming year.

A serious gumming disease of old beech trees at Burnham Beeches, supposed to be due to *Bulgaria polymorpha*, was described in the *Annals of Applied Biology* for 1917 by R. J. Tabor and Kate Barratt.

Two new fungi, parasitic on the leaves of Cyclamen, have recently been described by Dr. Trelease in volume 9 of the *Transactions of the Illinois Academy of Science*. One is *Ramularia cyclaminicola* and the other *Phyllosticta cyclaminicola*.

Mr. S. C. Bruner, of the Cuban Experiment Station, has studied a new canker occurring on the trunk and larger branches of *Eucalyptus* and described the causal fungus as *Diaporthe cubensis*. Some species of *Eucalyptus* are found to be entirely immune to this disease.

Among the many interesting specimens collected by Mr. Percy Wilson in Sullivan County, New York, last summer, may be mentioned *Fomitiporella betulina,* on yellow birch; *Elfvingia megaloma,* on rhododendron; and *Funalia stuppea,* on poplar. Sullivan County is within the Local Flora range.

"Peach-Growing," by H. P. Gould, published by the Macmillan Company, contains 25 pages devoted to peach diseases caused by fungi, among them brown-rot, peach-scab, leaf-curl, powdery mildew, rust, crown-gall, root rot, and several other diseases.

In the first number of *Botanical Abstracts,* which appeared last autumn, eight pages are devoted to Plant Pathology under the editorship of Donald Reddick, and a page to the Taxonomy of Non-Vascular Cryptogams, with J. R. Schramm as editor.

This valuable new journal makes an excellent impression and we wish for it the greatest success.

In *Science* for December 27, 1918, Dr. A. H. Graves discusses the results of his investigations in the vicinity of New York City relative to immunity in the chestnut to the canker disease. No immune trees were found, but a number of resistant trees were located, which, according to Dr. Graves, give promise of highly resistant strains through inbreeding and crossing with resistant oriental species.

The very mild autumn weather gave rise to considerable mushroom growth. Mr. W. H. Ballou found near White Plains, on December 21, the following specimen in a growing condition: *Pleurotus ostreatus, Pleurotus serotinus, Hypholoma perplexum, Collybia velutipes, Elfvingia fomentaria, Ganoderma sessile,* and *Phlebia radiata.*

Volume I of the *Memoirs of the Brooklyn Botanic Garden,* issued July 6, 1918, contains papers presented at the dedication of

the laboratory building and plant houses in April, 1917. Of the 33 papers published in this handsome volume of 521 pages and many illustrations, 10 are mycological in character, contributed by Atkinson, Dodge, Jackson, Kunkel, Metcalf, Murrill, Olive, Reed, Shear, and Smith.

The Rose Canker and Its Control is the subject of a *Bulletin of the Massachusetts Agricultural Experiment Station,* published in May, 1918, under the authorship of Dr. P. J. Anderson. This disease, sometimes called the crown-canker of the rose, is comparatively new, having been known as a parasite only two years. The causal fungus is *Cylindrocladium scoparium* Morgan. A full description of the fungus and its effects, as well as various methods of control, are given in the bulletin mentioned.

A recent paper on Some Singapore Boletinae, by Patouillard and C. F. Baker, contains descriptions of 16 new species of Boleti collected during a period of frequent showers in the Singapore Botanical Gardens. These specimens are as follows: *Boletus aureo-mycetinus, B. spinifer, B. tristis, B. phaeocephalus, B. nigricans, B. umbrinellus, B. veluticeps, B. cyanopus, B. viscidulus, B. retisporus, B. pernanus, Boletopsis corrugatus, Boletopsis icterinus, Boletopsis singaporensis, Phylloporus malaccensis,* and *Strobilomyces porphyrius.*

Professor F. S. Earle has been sending a number of specimens of woody and fleshy fungi to the Garden herbarium from Porto Rico, where Mr. Edgar Nelson has now joined him. Regarding the gill-fungi, Professor Earle writes, under date of December 24, "They are certainly very rare in the region of Rio Piedras, being chiefly represented by species of *Marasmius* and *Lepiota.* They are very local and only appear when weather conditions are just right. I do not doubt, however, that the Island will yet afford a long list of them."

Severe parasitic wood-rots of peach trees, due to *Coriolus prolificans* and *C. versicolor,* were observed by Mr. John A.

Elliott, near Lamar, Arkansas, and an account of them published in the December number of *Phytopathology*. The trees had been heavily pruned and also grew on low, heavy soil. The parasitism of the fungi was evident from the fact that the trees had made a vigorous growth for one or two seasons following the cutting back, and had been checked by the destruction, not only of the heartwood of the older parts of the trees, but of the sapwood as well.

The campaign for the control of stem-rust of wheat through the eradication of the common barberry has aroused a widespread and effective sentiment against the shrub. This has resulted in the actual removal of the following estimated percentages of the plants located by a survey conducted by the United States Department of Agriculture: Northern Illinois, 60 per cent.; Wisconsin, 90 per cent.; Minnesota, 80 per cent.; North Dakota, 90 per cent.; South Dakota, 80 per cent.; Nebraska, 75 per cent.; and Iowa, 75 per cent.

Studies in the Mosaic Diseases of Plants by George W. Freiberg, published in the *Annals of the Missouri Botanical Garden* for April, 1917, contains many conclusions, among them the following: (1) Mosaic diseases are not caused by an unbalanced inorganic nutrition. (2) The infectious substance is an enzyme and not a "virus." (3) The reproduction of the mosaic enzyme can be accounted for on purely physiological grounds, but the factors which originally induced its formation are still unknown.

The Laboratory of Forest Pathology of the Bureau of Plant Industry, U. S. D. A., Dr. James R. Weir in charge, has been removed from Missoula, Montana, to Spokane, Washington, where it will be permanently installed in a fire-proof building. The most intensive work of this laboratory is centered in the great white pine forests of Idaho. To promote pathological investigation in this region, a permanent field station will be established; also a forest pathological museum.

All future communications should be addressed to Laboratory of Forest Pathology, Spokane, Washington.

Insect galls are interesting to most mycologists, who will be delighted to know that a large and valuable bulletin on this subject, fully illustrated with many drawings and photographs, has recently been prepared by Dr. E. P. Felt and published as *Bulletin 200 of the New York State Museum.* It is called A Key to American Insect Galls and one wonders how many pages would be required to fully describe the American species of galls if 310 pages have to be devoted simply to a key. It may be said, however, that a good many descriptive terms are employed in the key and that the excellent figures supplement these brief descriptions in a highly satisfactory manner. Dr. Felt is to be congratulated upon the preparation and publication of this much needed work.

On Christmas Day, the following specimens, most of them in a growing condition, were collected in Saxon Woods, near White Plains, and presented to the Garden by Mr. W. H. Ballou.

Daedalea confragosa, D. quercina, Elfvingia megaloma, Hexagona alveolaris, Lenzites betulina, Fomes populinus, Polyporus Polyporus, Bjerkandera adusta, Coriolus nigromarginatus, C. versicolor, C. prolificans, Tyromyces chioneus, Coriolellus sepium, Irpiciporus lacteus, Hydnoporia fuscescens, Poria subacida, Corticium effuscatum, Stereum lobatum, S. complicatum, Merulius tremellosus, Exidia arborea, Auricularia Auricula, Guepinia spathularia, Claudopus nidulans, Panellus stypticus, and *Geaster hygrometricus.*

A paper recently published in the *Journal of Agricultural Research* by Stakman and others on the plasticity of biologic forms of *Puccinia graminis* deals with questions of deep significance and importance. Among the conclusions reached are the following:

No one so-called bridging host nor any combination of such hosts enabled any biologic form tried to infect naturally immune plants nor to infect a highly resistant plant more readily.

Many attempts were made to increase the virulence of biologic forms on resistant hosts by successive transfers to these hosts. The results indicated that rust forms do not gradually adapt themselves to resistant or semicongenial hosts.

Biologic forms seem to be roughly analogous to pure lines. Plus and minus fluctuations may occur, but there is always a tendency to return to normal.

The facts given in this paper do not support the conclusions of previous workers that the pathogenicity of biologic forms is easily changed by host influence.

From the practical standpoint the constancy of biologic forms is of great importance. Breeding for rust resistance can proceed with considerable assurance that the same rust will not adapt itself quickly to new varieties.

GEORGE FRANCIS ATKINSON

Professor Atkinson died in the City Hospital, Tacoma, Washington, on November 14, 1918, from pneumonia following an attack of Spanish influenza. He was recently relieved of active work at Cornell University, where he had been Head of the Department of Botany since 1896, to prepare his extensive notes and photographs of the fleshy fungi for publication. In order to make this work more complete, he was engaged in collecting fungi in regions he had not previously visited, his last explorations being on Mt. Rainier and about Tacoma.

Professor Atkinson has served as a member of the Advisory Board of *North American Flora,* published by the New York Botanical Garden, since the beginning of that work in 1905; and was an associate editor of the *Botanical Gazette.* His publications cover a wide range of subjects, including plant pathology, morphology, taxonomy, embryology, heredity, life-history, etc. He was the author of a number of botanical text-books and numerous contributions to botanical journals, making a total of over 125 titles.

The enthusiasm and energy displayed by Professor Atkinson in personal research and in directing the investigations of others has scarcely been equaled. To his students in all parts of the country,

as well as to his professional associates, his unexpected death comes as a great shock.

W. A. MURRILL

EXTENSION OF WORK IN PLANT PATHOLOGY

Mr. J. A. McClintock has resigned his position as Extension Specialist in Cotton, Truck and Forage Crop Diseases, to which he had been appointed under a joint project between the U. S. Department of Agriculture and the Georgia State College of Agriculture, and will hereafter be located at Experiment. During the coming year it is planned to enlarge the work materially, both along extension and investigational lines. Plans are under consideration which will result in the appointment of two or three additional specialists. Mr. McClintock's successor will be appointed as soon as a suitable man is located. In addition there will be a specialist who will devote his entire time to corn diseases, especially the root rots. A third specialist will have charge of the disease of small grains, the emphasis being directed toward the perfection of control measures for smut and rust.

The Plant Disease Survey of the past season has been wonderfully productive of results. The college now has in hand complete data as to the prevalence and extent of each of the commercially important diseases. During the coming year it is planned to detail a specialist in disease survey to the state for several months to assist in the work.

The laboratory and greenhouse facilities for the use of the Division of Plant Pathology will be considerably augmented and the investigative work will be extended as a result. All research work and extension activities for the state will be carried on directly from the college, under the direction of the Division of Plant Pathology.

J. B. BERRY

ATHENS, GEORGIA.

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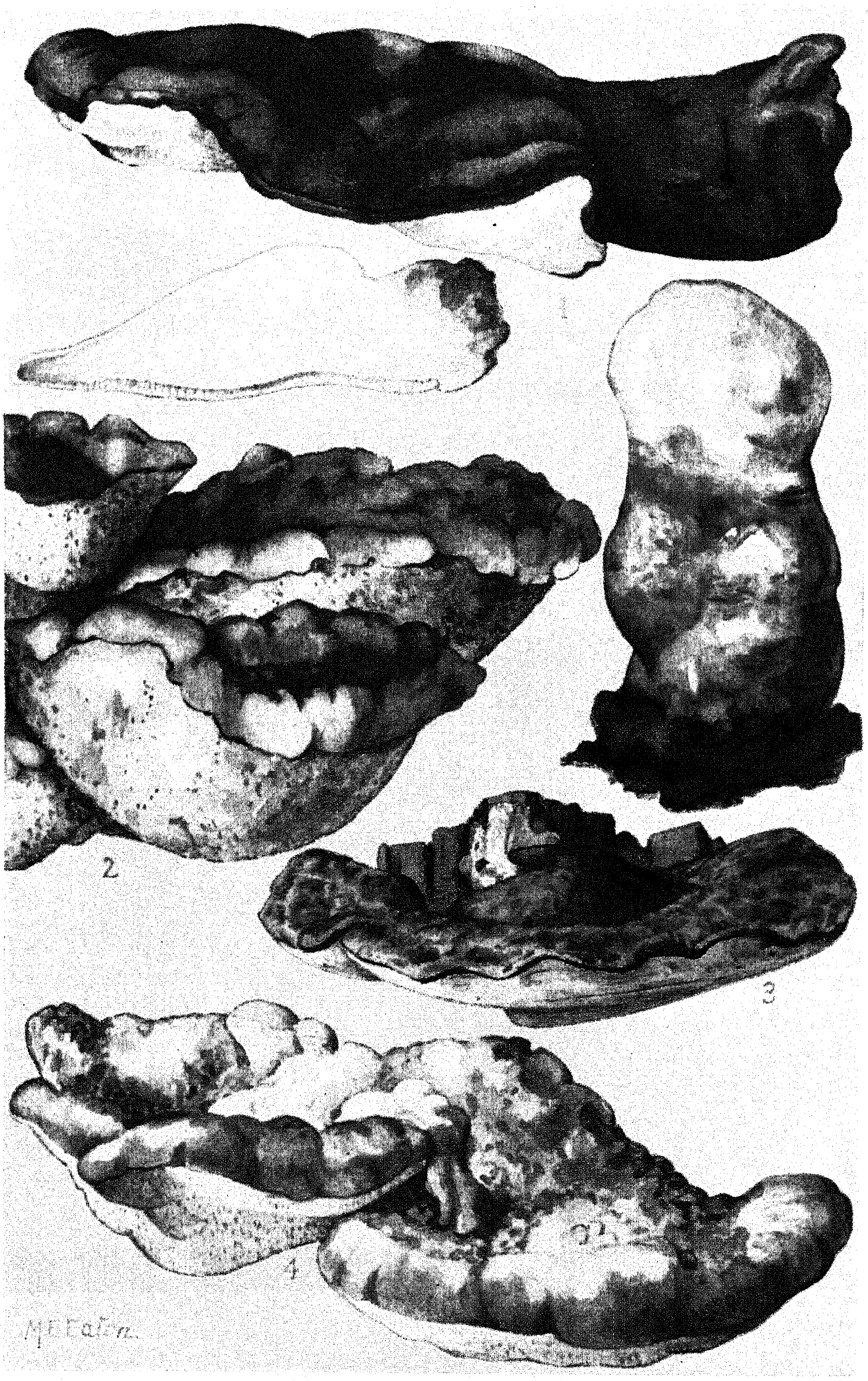

ILLUSTRATIONS OF FUNGI

MYCOLOGIA

VOL. XI MAY, 1919 No. 3

ILLUSTRATIONS OF FUNGI—XXX

WILLIAM A. MURRILL

In the accompanying plate, an attempt has been made to illustrate a few of the larger polypores, which would require much more space for adequate representation. The species selected occur on living or dead trees in the vicinity of New York City, some of them in abundance.

Ganoderma Tsugae Murrill

HEMLOCK GANODERMA

Plate 6. Figure 1. × ½

Pileus corky to woody, fan-shaped, convex above, concave below, 4–20 × 5–25 × 1–4 cm.; surface glabrous, uneven, concentrically sulcate, laccate, lustrous, yellowish-red to mahogany-colored, at length black; margin light-yellow, acute, becoming concolorous, truncate, and marked with many shallow furrows, often undulate and at times more or less lobed; context soft-corky, radiate-fibrous, white or nearly so, 1–3 cm. thick; tubes annual, 0.5–0.75 cm. long, 4–6 to a mm., brown within, mouths circular or polygonal, white to light-cinnamon, edges obtuse, becoming acute; spores ovoid, obtuse at the base, attenuate and truncate at the apex, appearing verrucose, yellowish-brown, 9–11 × 6–8 μ; stipe lateral, ascending, frequently forked, cylindric, equal, 2–20 × 1–4 cm., resembling the pileus in color, surface and context.

Common on decaying trunks, stumps, and roots of hemlock throughout the range of this tree in America. The varnish begins to exude from the very young hymenophore, as shown in the figure, and soon spreads over the entire surface. The generic name refers to this character.

[MYCOLOGIA for March (11: 51–100) was issued March 17, 1919.]

Inonotus dryophilus (Berk.) Murrill

OAK-LOVING INONOTUS

Plate 6. Figure 2. × 1

Pileus thick, unequal, unguliform, subimbricate, rigid, 7–8 × 10–14 × 2–3 cm.; surface hoary-flavous to ferruginous-fulvous, becoming scabrous and bay with age; margin thick, usually obtuse, sterile, pallid, entire or undulate; context ferruginous to fulvous, zonate, shining, 3–10 mm. thick; tubes slender, concolorous with the context, about 1 cm. long, mouths regular, angular, 2–3 to a mm., glistening, whitish-isabelline to dark-fulvous, edges thin, entire to toothed; spores subglobose, deep-ferruginous, 6–7 μ; cystidia scanty and short; hyphae deep-ferruginous.

Occasional on living or dead oak trunks throughout the United states, causing serious decay. The specimen figured was taken from a living white oak in the New York Botanical Garden in September, 1912. See *Mycologia* 1: 84 and 9: 39.

Ganoderma sessile Murrill

SESSILE GANODERMA

Plate 6. Figure 3. × ½

Pileus corky to woody, dimidiate, sessile or stipitate, imbricate or connate at times, conchate to fan-shaped, thickest behind, thin at the margin, 5–15 × 7–25 × 1–3 cm.; surface glabrous, laccate, shining, radiate-rugose, concentrically sulcate, yellow to reddish-chestnut, at length opaque, dark-brown, usually marked near the margin with alternating bay and tawny zones; margin usually very thin and acute, often curved downward, often undulate, rarely becoming truncate, white, at length concolorous; context soft-corky or woody, radiate-fibrous, concentrically banded, ochraceous-fulvous; tubes 0.5–2 cm. long, 3–5 to a mm., brown within, mouths circular or angular, white or grayish-brown, edges thin, entire; spores ovoid, obtuse at the base, attenuate and truncate at the apex, appearing verrucose, yellowish-brown, 9–11 × 6–8 μ; stipe laterally attached, usually ascending, irregularly cylindric, 1–4 × 0.5–1.5 cm., resembling the pileus in color, surface and substance, often obsolete.

Frequent on diseased trunks and dead stumps from New England to Ohio, Missouri, and southward. Described in 1902 from sessile forms found on stumps of deciduous trees about New

York City. The specimen figured grew on a red maple stump. Stipitate forms also occur and may possibly connect it with *Ganoderma lucidum* of Europe.

Tyromyces Spraguei (Berk. & Curt.) Murrill

SPRAGUE'S TYROMYCES

Plate 6. Figure 4. × 1

Pileus subimbricate, dimidiate or flabelliform, broadly sessile or attenuate behind, convex, fleshy-tough and watery to rigid and fragile when dry, 4–7 × 5–10 × 1–2 cm.; surface at first milk-white, finely tomentose to glabrous, slightly tuberculose, azonate, sodden, containing depressions filled with exuded water, becoming discolored and roughened and often decaying, especially in damp weather, with a strong and disagreeable odor; margin undulate or slightly lobed, acute, usually discolored, sometimes smoky-black, inflexed when dry; context white, zonate, cheesy when fresh, rigid and somewhat fragile when dry; tubes small, white to yellowish within, 3–8 mm. long, mouths somewhat uneven, angular, 3–4 to a mm., edges white to yellowish, thin, entire; spores ellipsoid, smooth, hyaline, $6 \times 4\,\mu$.

Common in the eastern United States on decaying stumps and trunks of chestnut and oak. The specimen figured was taken from a white oak tree in the New York Botanical Garden.

NEW YORK BOTANICAL GARDEN.

THE CANADIAN TUCKAHOE

H. T. Güssow

(With Plates 7–9)

During some eight years past there have been received and examined, from the wooded regions (principally poplar woods) of the provinces of Manitoba and Saskatchewan, a number of large fungous sclerotia, such as one finds occasionally referred to in literature. Nearly all these references are sufficiently definite in showing that sclerotia similar to those under examination here have been frequently enough observed, but all records are as cautious as they are meager in supplying critical information relating to the classification of these sclerotia.

Of the twenty and more specimens seen from time to time, it may be said that they agree in character, appearance and composition, and no doubt are all identical.

They ranged from the size of a hen's egg to that of a cocoanut still within its fibrous covering. The largest specimen seen by us was an oval body and measured when fresh 22 inches by 33½ inches in circumference; its weight was 8 lbs. 4 ozs. After several years' drying, this sclerotium was reduced in size to 20 inches by 29 inches, and in weight to 6 lbs. 13 ozs.

On arrival and while still fresh, these masses bounce like a solid rubber ball, though not quite as readily. The exterior is coal black, not glossy but quite mat. They often contain a number of small stones; in one case one as large as a hen's egg was more than three quarters firmly embedded. Generally there were exhibited grooves resulting from enclosed roots, which in most cases, however, had rotted away. One of these grooves is plainly shown in the left-hand specimen of Plate 7. The external structure is not very definite, showing merely minute irregular fissures.

In cutting through a specimen, the knife frequently strikes embedded grains of sand and small stones. The crust of the

sclerotium differs in color perceptibly from the interior. There is a pronounced coal-black layer readily distinguished from the interior substance. The bark seems structureless in our specimens; on microscopical examination one finds but the debris of what might have been originally specialized hyphae.

The interior is blackish olive green, particularly when fresh, becoming more grayish black when dry, but its appearance on the whole is black, interspaced with many small crevices which are filled with dirty, white, very tough masses of hyphae. This gives the interior a mottled, marble-like effect. (Plate 7, center.)

Microscopically examined, the hyphae are of very irregular thickness. They are thick-walled and show numerous curious hooks and clamps and an occasional anastomosis. (Plate 9*A*.)

The darker substance, which resembles rubber, evidently also consists of hyphae, considerably thicker and almost solid when moistened. The difference in size between the hyphae composing the light and dark masses, is plainly shown in our attempt to interpret the interior structure of these sclerotia. (Plate 9*B*.)

When thoroughly dry, the sclerotia became as hard as stone and once they had dried out would not produce any fruiting bodies, but merely decomposed when buried in the soil.

The habitat of these sclerotia is invariably among the roots of poplar woods. They are found generally after land has been cleared and the ground backset afterwards by the plough. Correspondents frequently report having seen them attached to roots. This has given rise to the statement that they might be parasitic. The wood to which the sclerotia are attached is filled with hyphae, but we have no first-hand evidence that they derive more benefit from being attached to a root—although there exists such probability—than from the stones with which they are often intimately associated.

The next striking statement is that these bodies are edible, but we ourselves could not exert any marked effect on them with our teeth, though in the interests of mycophagists we tried them raw and cooked. Cooked, they became slightly jellified, but a jelly itself was not produced.

The late James Fletcher (1) gave a preliminary account of his

observations with what we are confident were sclerotia similar to our own. Dr. Fletcher planted some of these sclerotia in 1906, and a year later he had the great satisfaction of finding two fleshy "toadstools" growing from the sclerotia, which he stated he had so far not identified. He gave a very brief description of the fungi, and referred them to the genus *Polyporus*. The photographs which accompany his note unfortunately show nothing beyond the fact that the sclerotia produced fruiting bodies. Similar success attached to some specimens of the same consignment which Professor Thaxter planted. His, also, after being planted two years, yielded a fruiting body, a form of *Polyporus*, which he turned over to Dr. Farlow.

Dr. Farlow mentioned in this connection a popular article by J. H. Gore (2) dealing with a Southern Tuckahoe or "Indian Bread." The fungus dealt with by Gore is obviously not the same as ours.

Some time ago, on August 1, 1914, we planted a sclerotium recently received, and in splendid condition, which produced ten months later a fruiting body. The sclerotium in question weighed about 13 ozs. and came from Manitoba, where it had been dug up in a field formerly a poplar bush; it was planted in a nine-inch flower pot about three inches below the soil surface and the pot was embedded in the ground outdoors. Towards the beginning of June, 1915, we observed a small fungus body developing. This grew to the size of a filbert and then died. A few days later another more vigorous fruiting body made its appearance, but so close to the edge of the pot that we feared its shape would be affected. So far as we could observe without disturbing the specimen, the margin of the cap was but slightly incurved. Towards the end of June the sporophore had matured and began shedding large masses of white spores (Plate 8).

The cap was almost sessile, the stem proper being only about half an inch above ground.

The surface of the cap measured 5 inches by 3½ inches. The pileus was thick, soft fleshy, like cheese in texture, and irregularly lobed, with one particular prominent imbricate lobe. This made the stipe appear almost eccentric. The pileus was at first hemi-

spheric to convex, but later became plano-convex with slightly upturned margin, exposing the tubes of the hymenium. The surface was dry, soft and silky to the touch. The flesh was thick in the center, whereas the margin or edge was decidedly thin, only about 1/16 of an inch, whilst the tubes towards the edge were nearly 1/4 of an inch in length.

The color of the pileus was at first light brown but became buff to ochraceous with age. The surface appeared covered with minute, dark buff scales. The margin was very definitely of lighter color than the rest of the cap. (See figure of pileus, Plate 8.)

The hymenium was dusty from the spores, but otherwise almost the same color as the cap, but slightly grayish, very soft and moist as in some Boleti. The tubes were large, angular to sinuous, nearly twice as long as broad, and later on appeared shallow and the pores lacerated. The tubes are longest towards the dome of the pileus, but become shallow towards the stem, almost resembling reticulations as they become decurrent.

The spores are hyaline, white in a mass, smooth, often narrow in the middle, but generally ovoid to ellipsoid, with one to several little oil globules. The average size is 10–17 μ by 4–7 μ.

The stem is solid, compound to branched, almost entirely below ground, rising from a solid sclerotium. Only about half an inch of the stem in our specimen showed the same color as the tubes, the rest was covered with soil particles firmly held. It was about 2½ inches long by ½ an inch thick. Length no doubt is determined by the depth the sclerotium is buried.

These notes have been taken from only one living specimen seen, and are as accurate as they could be made, but which of the characters referred to are permanent and specific, and which may vary, can only be determined from a series of specimens. It is interesting to record that while we may come across many references to sclerotia-bearing fungi in literature, yet the descriptions of any of those resembling our specimens are meager and indefinite.

Beginning, for instance, with Fries' *Pachyma cocos,* to which nearly all authors refer the term Tuckahoe, we cannot identify

our fungus as *Pachyma* in the absence of any fructifications known in his fungus; moreover our sclerotia were never white nor fleshy within.

The "native" or "black fellows" bread (3) of Australia and Tasmania (*Polyporus Mylittae* Mass.) also disagrees in description with our specimen. Then there is the specimen of Möller from southern Brazil, *Polyporus Sapurema*, with a sclerotium up to 40 lbs. in weight, apparently quite different from the Canadian specimen (4).

In Italy, "pietra fungaia," or the sclerotium of the fungus *Polyporus tuberaster* (Jacq.) Fries (5), seems to have received the most attention and excellent descriptions have been made. For a reference to the latest description of this fungus (6) we are greatly indebted to Professor Farlow, who with usual courtesy was good enough to copy for us the description therein given.

While our fungus is close to *P. tuberaster*, our sclerotia apparently differ very greatly from those of the former. The tubes in our form were never white, but yellowish from an early stage. The pores in our specimen are large and angular, in *P. tuberaster* small and round, though later becoming angular.

C. G. Lloyd (7), who speaks of specimens he has seen in Europe, states that *P. tuberaster* does not really have a true sclerotium. The hard masses are formed of earth, cemented into a stone-like body by the mycelium of the fungus. In this connection all descriptions of the sclerotia of *P. tuberaster* agree, but our sclerotia are quite different in structure and do not in any way resemble masses of earth cemented by fungus mycelium. We have occasionally observed masses of this description, some more like a sclerotium than others, but all of them altogether different from the Canadian Tuckahoe.

From a general survey of the forms to which this polypore may be referred, it would seem that the European *P. cristatus* Fr. bears considerable resemblance to it.

C. G. Lloyd, with usual candor, places himself on record as considering *P. cristatus* as probably identical with the American species *P. flavo-virens* Berk. et Rav., to which our form certainly comes very close.

Some authors are inclined to include *P. tuberaster* and *P. Sapurema* with *P. flavo-virens*.

At any rate we feel fairly confident in referring our fruiting body to the genus *Grifola* as revised by Murrill (8), since the generic characters agree satisfactorily.

The question of species is much more difficult; it would seem that the specific characters of this fungus do not agree with those of any of the species given by Murrill under *Grifola*. Later and more complete descriptions only, will settle some minor points. We regard our specimen as deserving specific rank, and in order to connect the Indian term Tuckahoe definitely with the fungus that has been grown from several of them, it is proposed to tentatively name it *Grifola Tuckahoe,* with the following brief diagnosis:

Grifola Tuckahoe sp. nov.

Pileus fleshy, stipitate, lobed to imbricate, convex to plano-convex, 7–13 cm. (and more) in diameter, ochraceous to buff tawny, covered with minute dark scales on surface. Flesh soft, thick, light yellow to brown. Stipe central (to lateral), short, stout, compound. Tubes ochre to yellow brown, large, angular to sinuous, shallow and decurrent towards stipe, lacerate with age. Spores hyaline, guttulate, ovoid to ellipsoid, 4–7 μ by 10–17 μ, grayish-white in mass.

Habitat in poplar woods of Manitoba and Saskatchewan, growing from large coal-black rubber-like sclerotia, popularly known as Tuckahoe.

CENTRAL EXPERIMENTAL FARM,
OTTAWA, CANADA.

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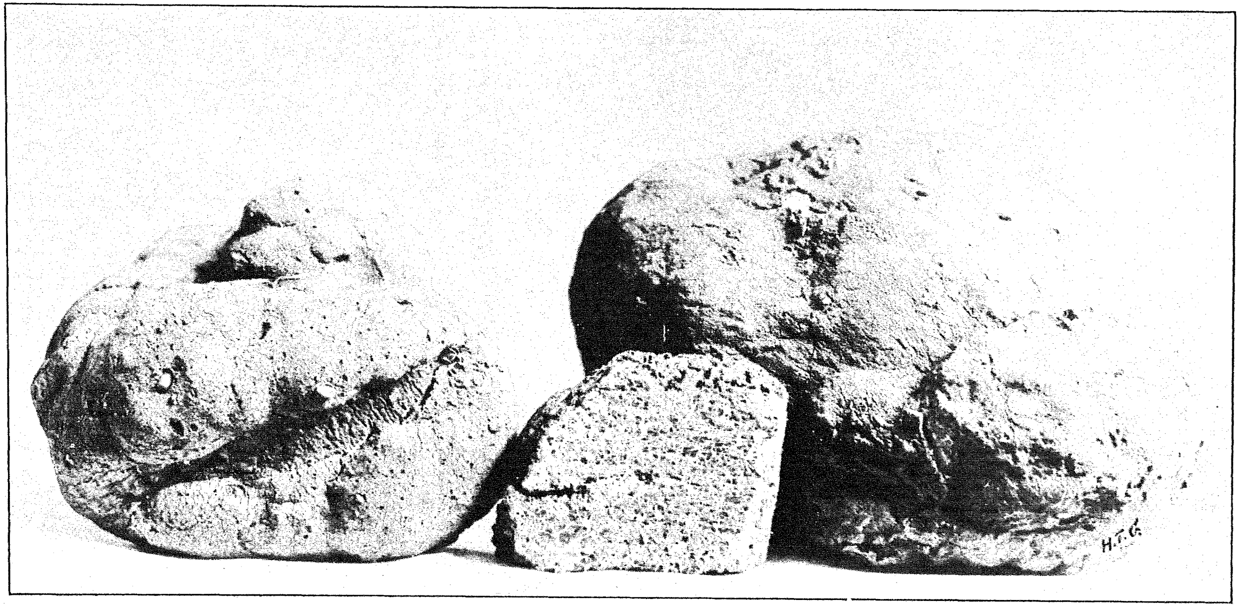
EXPLANATION OF PLATES

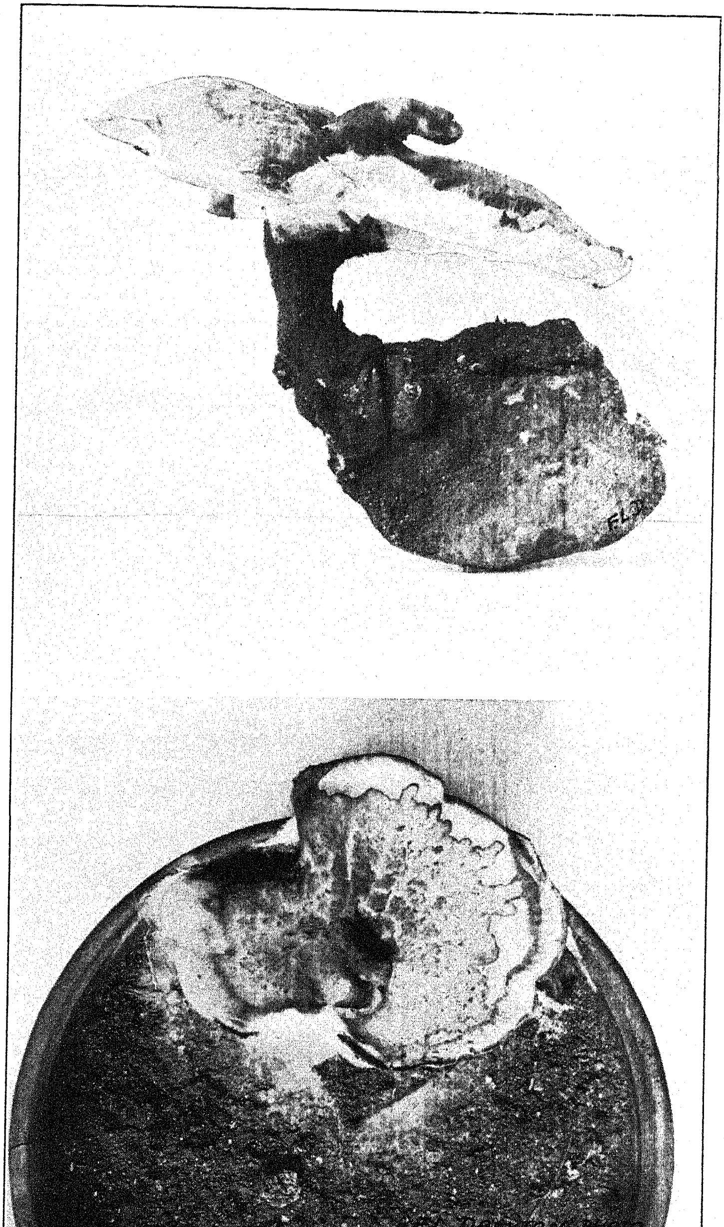
Plate 7. Underground sclerotia of the Canadian Tuckahoe (*Grifola Tuckahoe* Güssow). Left specimen showing groove resulting from attachment to root. Central specimen, portion of sectional sclerotium. The largest specimen shown weighed 8 lbs. 4 ozs.

Plate 8. Fruiting bodies growing from sclerotium of Tuckahoe.

Plate 9. *A,* Mycelial hyphae from interior of sclerotia showing hooks and clamp cells; *B,* structure of black substance of sclerotium showing size of the two mycelia present; *C,* spores of *Grifolia Tuckahoe; D,* germination from one to four days; *E,* pores of hymenium; *F,* diagram showing relative size of tubes to pileus.



GRIFOLA TUCKAHOE Güssow



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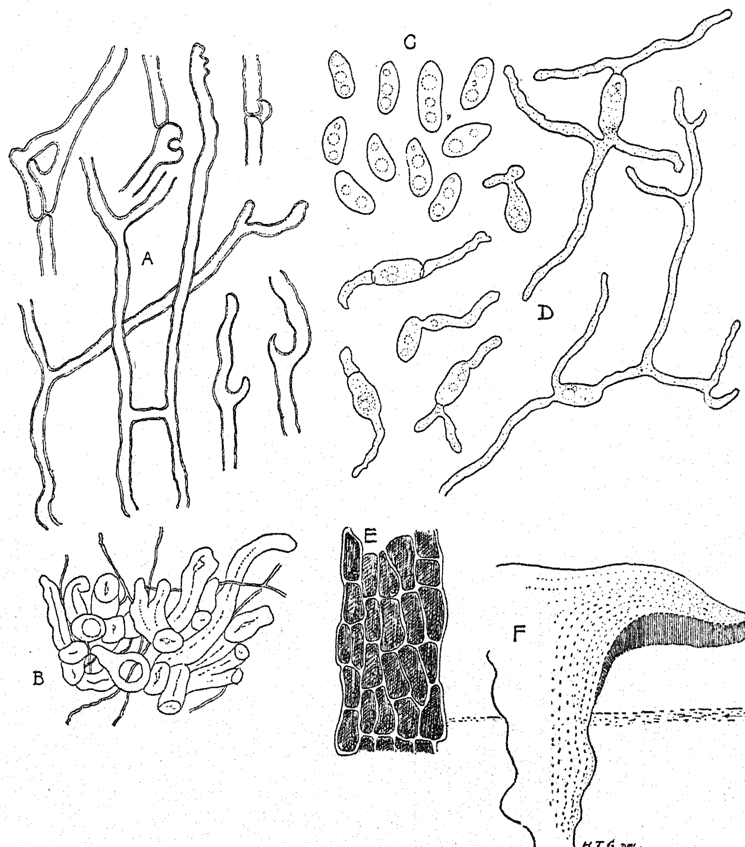


GRIFOLA TUCKAHOE Güssow

SOME DISEASES OF TREES IN GREATER NEW YORK

Arthur Harmount Graves

(With Plate 10, Containing 4 Figures)

In the course of field work carried on by the writer in Greater New York and the adjacent parts of New Jersey in the summer of 1918, several diseases of forest trees were incidentally studied: those selected for the present paper are important on account of their destructiveness, or interesting by reason of their rarity, or demand attention because they are little understood and need further investigation. A few notes on injury from the extremely disastrous winter of 1917–1918 are added.

The writer wishes to acknowledge his indebtedness to the many persons, some of them named in the text of this paper, who have contributed information or assistance toward its preparation; and to the botanical staff of Yale University for generously placing the Osborn Botanical Laboratory at his disposal for the culture and microscopic work involved.

The diseases are arranged according to host species, the sequence of hosts following that of Sudworth's Check List of the Forest Trees of the United States.[1]

I. Bark Disease of the Butternut (*Juglans cinerea* L.)

Almost without exception the mature butternut trees in the region surveyed were in a moribund condition, sometimes only a few of the smaller branches being dead, while in extreme cases the entire tree had succumbed. Usually the disease appeared to commence on the branches, both those at the top of the tree as well as at the sides of the trunk being affected. During the death of the distal portion of a branch another would develop further

1 Sudworth, George B. Check list of the forest trees of the United States. U. S. Dept. Agr., Forest Service Bul. 17: 1–144. 1898.

down as a side shoot: this would be eventually killed in its turn, another would arise further down, etc. Thus, while the distal portion of the branch was dead and often entirely devoid of bark, living shoots could be found below. Eventually the whole branch would die and others, sometimes appearing at the branch axil at the trunk would be killed in their turn. It seemed as if the disease entered the trunk in this way, via the dead branches, the death of those at the top of the tree causing a stagheaded aspect characteristic of the disease. Only in a few cases was a prominent crown of suckers observed on the trunk such as occurs in the chestnut bark disease. However, the large number of new branches, mainly orthotropous, which had arisen in the manner described, marked the affected trees in a distinctive manner. Eventually, the death of the whole tree ensued.

That the progress of the disease was slow was indicated, among other things, by the fact that no sudden wilting of the leaves occurred on the affected parts. Moreover, the writer has observed trees in the neighborhood of New Haven, Conn., afflicted with this trouble, or something very similar, for a number of years, and they are not yet entirely dead. It is significant that butternut fruits have been scarce about New Haven for many years.

Dr. G. P. Clinton says that he has noticed the trouble for a number of years, and while he has not investigated it carefully, has had the general impression that the cause is to be looked for in a general decline in the vigor of the host species, just as he believes is the case with the American chestnut and with *Hicoria*. Mr. J. J. Levison, formerly N. Y. City forester, and now consulting forester at Sea Cliff, L. I., states that he has also noticed the disease for some years. Last summer the writer saw affected trees in Pennsylvania and Maryland, and this winter at West Hartford, Conn. Apparently the disease is widespread.

There was no evidence of insect injury about the trees, but wherever it was possible to examine closely one of the diseased limbs the fungus *Melanconium oblongum* Berk. was conspicuous on the dead bark, and often in the immediate vicinity of the healthy tissue. The diseased inner bark was much blackened and formed a strong contrast to the light colored healthy inner bark, the line of demarcation between the two being very clearly defined.

Melanconium oblongum Berk. has been collected many times in the U. S., but almost entirely, so far as the writer can ascertain, on *Juglans cinerea*.[2] Berkeley first described it from specimens from the United States in 1873–4.[3] From an examination of published descriptions of *Melanconium* species and from a study of exsiccati we suspect that the organism has several aliases, but until the criminal evidence is more conclusive it is not worth while to discuss them here. Dr. Shear collected the fungus in 1893 in close association with *Diaporthe juglandis* E. & E., and according to a note by him in the herbarium of the N. Y. Botanical Garden, he believed the latter species might be the perfect form of *Melanconium oblongum.*

The spores of the fungus are brown, elliptical-oblong, with homogenous granular contents, or often containing one or more drops or vacuoles, and measure about 20 μ in length.

It is possible that the fungus may prove to be a slow parasite, but of course the only evidence in support of this is its constant association with the disease. However, another species of this genus, *Melanconium sacchari,* is usually accredited with being the causal agent of a destructive disease of sugar cane.[4] There is need of further work, particularly inoculation experiments, to throw light on the question.[4a]

II. NECTRIA CANKER OF THE SWEET BIRCH (*Betula lenta* L.)

This was easily to be reckoned the most destructive disease of the sweet birch in the New York area, and is causing a great deal of damage. The writer has had the trouble under observation since 1909, having first observed it in a forest at Orange, Conn.

2 Collected by Ellis at Newfield, N. J., on *Juglans regia,* 1892. The writer has made an effort to find the fungus on *Juglans nigra* L., but without success.

3 Berkeley, M. J. Notices of North American fungi. Grevillea **2**: 153. 1873–4.

4 Cook, Mel. T. The diseases of tropical plants. Pp. 81 ff. New York, 1913.

4a Healthy twigs of butternut, brought into the greenhouse in March, 1919, and inoculated from a pure culture of the fungus, had, on April 26, as this paper is going to press, developed 33 infections out of 59 inoculations. 19 of these 33 showed spore pustules of *Melanconium oblongum.* Checks remained uninfected. A similar series on black walnut gave negative results.

In the New York region, no tract where *Betula lenta* formed a fair per cent. of the stand was free from the disease. In the fall of 1918 a forest at Milford, Conn., was visited, where about 50 per cent. of the stand was sweet birch, and at least 90 per cent. of the trees were affected. Dr. G. P. Clinton states that he has noticed the trouble for many years, and showed the writer specimens collected on *Betula lenta* near New Haven in 1906. The writer collected specimens of the causal fungus, *Creonectria coccinea* (Pers.) Seaver (*Nectria coccinea* Fr.) from trees in Van Cortlandt Park, Mt. St. Vincent, Staten Island, and the terminal moraine north of Hollis, L. I., but the disease was seen in many other localities.

The symptoms are typical lipped cankers, which if old are open, but in a younger stage may be still covered over with dead bark and then only appear as sunken spots with the bark cracked at the margins. Usually several cankers appear on a single tree, distributed at irregular intervals along the trunk and branches. Branches even as small as ½ inch in diameter may have the cankers, and such lesions, from their characteristic, irregular, nodular appearance, may be recognized readily from a distance. The fungus advances in the living bark during the season of inactivity of the host. Thus, during October, November and early December, and again in early spring, the new bark recently killed by the fungus can easily be observed by cutting in at the margins of the canker. The freshly diseased cortex has a sodden consistency and a dark reddish hue, contrasting sharply with the yellow color of the healthy inner bark, while at the boundary between the two a dark red line appears. With the new season's growth of the cambium, the inroads of the fungus are temporarily checked, to be resumed again in the fall. In this way the successively receding layers of wood about the canker are formed. The disease thus progresses slowly, and in many cases may be present in the tree for a long period, the increase in circumference of the tree more or less compensating for the loss of cortex through the fungous attack. One large tree, about 2½ feet in diameter, breast high, near Whitestone, L. I., was seen which had been affected apparently for many years, one of the cankers, near the

base of the trunk, being about 1½ feet in diameter. Often, however, trees are eventually killed out, especially if due to suppression their diameter growth is slow.

The fruiting bodies, or perithecia, begin to ripen in August; and although some were found to contain mature spores by the end of the month, in most cases the spores are not ripe until the latter part of September or in October. During the winter it is possible to obtain ripe fruiting bodies on almost any canker. Sometimes these are few and very inconspicuous, being scattered about singly or in twos or threes in crevices in the bark; but occasionally their aggregation in groups makes them readily visible. But even where very few, they can be easily detected with the naked eye (being a little less than .5 mm. in diameter) appearing as small, bright crimson dots, located on the diseased bark, not far from the border line of healthy and diseased tissue. In shape the perithecia are ovoid: 19 specimens taken from different sources measured $406 \times 288 \mu$.

The ascospores are colorless, two-celled, and when ripe, often show pronounced constriction at the septum. The majority of the specimens examined were very blunt or rounded at the ends when mature, although many were fusoid, and in the younger stages they were always fairly sharp pointed. Measurements of 75 spores from various sources, averaged $14.5 \times 7.5 \mu$. These figures agree with those given in the North American Flora,[5] except that our spores are a little wider. But Dr. Seaver, to whom specimens were submitted, says that there is no doubt that it is *Creonectria coccinea* (Pers.) Seaver.

Macroconidia developing from pure cultures on oat agar were yellow in mass, transparent when viewed under the microscope, averaging about $70 \times 6 \mu$, blunt at the ends and with 5 to 8 septa —usually 7. They are slightly curved, and usually a trifle thicker toward one end (Plate 10, fig. 4, *a*).

Of exsiccati, N. A. F. 161, *Nectria coccinea* Fr. collected at Newfield, N. J., on bark of dead *Magnolia,* showed spores averaging about $16 \times 5 \mu$, without constrictions. Fungi Col. 2043, *Nectria coccinea* Fr., on *Tilia americana,* London, Canada, showed

[5] Seaver, F. J. Hypocreales, in North American Flora 3^1: 21. 1910.

spores about $14 \times 5\,\mu$ and also without constrictions. These are nearer the figures given in the North American Flora.

Although this fungus, under the name of *Nectria ditissima* Tul., is presumably the cause of the "European apple-tree canker" in North America,[6, 7, 8] we have found no reference to it as a pathogenic organism on forest trees in North America, if we except the paper by Pollock,[9] in which he speaks of a fungus resembling *N. coccinea,* associated with a canker of the yellow birch (*Betula lutea* Michx. f.) in Michigan. Many points in his description coincide with the facts set forth above. In particular, his spores agree with ours in that they are wider than the figures cited in the type descriptions. Perhaps the variation in form is due to the influence of the host. Cook[10] has reported a *Nectria* parasitic on the Norway maple, but was unable to determine the species with certainty. In correspondence with the writer he has stated that it was probably *Nectria cinnabarina.*

As already intimated, *Nectria ditissima* Tul. as well as *N. coccinea* Fr. are considered synonyms of *Creonectria coccinea* (Pers.) by Seaver in the treatment in North American Flora. Yet there still seems to be some confusion as to just what is meant by *Nectria ditissima* Tul. Seaver[11] says: "So far as we can see the species (*Creonectria coccinea*) scarcely differs from *Nectria ditissima* Tul. If the two species are distinct, the characters are so poorly understood that they have been badly confused." We have for a long time been accustomed to regarding *Nectria ditissima* Tul. as the causal fungus of the canker of deciduous trees in Europe. And yet, according to Shear,[12] Euro-

[6] Wilson, G. W. Notes on three limb diseases of apple. N. C. Agr. Expt. Sta. Rept. 35: 49. 1913.

[7] Duggar, B. M. Fungous diseases of plants. Pp. 242–243. 1909.

[8] Morse, W. J. Spraying experiments and apple diseases in 1913. Me. Agr. Expt. Sta. Bul. 223: pp. 23–24. 1913.

[9] Pollock, J. B. A canker of the yellow birch and a Nectria associated with it. Mich. Acad. of Sci. Rept. 7: 55–56. 1905.

[10] Cook, Mel. T. A Nectria parasitic on the Norway maple. Phytopath. 7: 313–314. 1917.

[11] Seaver, F. J. The Hypocreales on North America. Mycologia 1: 188–189. 1909.

[12] Shear, C. L. Some observations on phytopathological problems in Europe and America. Phytopath. 3: 80 ff. 1913.

pean mycologists have recently stated that the fungus causing the apple canker in Europe has been incorrectly identified and is not *Nectria ditissima* Tul. but *Nectria galligena* Bres., a fungus which has not been reported from this country. It seems probable, therefore, that the true European Nectria canker does not occur here." No exsiccati of *N. galligena* Bres. have been available for examination, but the description by Wollenweber[13] agrees with our form in all points, especially as regards ascospores and macroconidia.

Without entering into further discussion, it would seem to the writer very desirable that a comparative study involving both cultural and infection methods be carried on for *Creonectria coccinea* and *Nectria galligena* to determine whether they are really distinct.

III. WINTER INJURY OR LEAF SCORCH OF THE BEECH (*Fagus atropunicea* (Marsh.) Sudw.)

Diseased or dying beeches were observed all over the region explored, particularly in Van Cortlandt Park, the Palisades of the Hudson and Staten Island. The most striking symptom was a reddish-brown coloration of the tips and margins of the leaves, and this often extended in irregular patches between the parallel veinlets characteristic of this leaf down to the midrib. In many cases the bark of the trunk and branches was quite sound; in others, whole branches were entirely dead, especially toward the top of the tree. No fungus was apparent on the leaves, nor was any pathogenic form discovered on the dead bark. All the evidence, therefore, pointed to a root trouble. If we take into consideration the very severe winter of 1917–18, there is no doubt that the extreme conditions occurring then killed out a portion, at least, of the roots. Whether these trees will recover or not depends on the relative amount of damage to the root system. All the dead branches should be pruned off and the living ones also cut back heavily in order that the tree may regain the balance

13 Wollenweber, H. W. Ramularia, Mycosphaerella, Nectria, Calonectria. Eine morphologisch pathologische Studie zur Abgrenzung von Pilzgruppen mit cylindrischen und sichelförmigen konidienformen. Phytopath. 3: 197–242, *pl. 1–3.* 1913. See also another paper by the same author: Studies on the Fusarium problem. Phytopath. 3: 24–51. 1913.

between root and shoot system, and, in the balance account, perhaps have a little credit left on the side of the root system.

IV. Heart Rot of Oak (*Quercus* spp.)

Three fungi of interest were observed causing heart rot of different species of oak, as follows:

1. *Globifomes graveolens* (Schw.) Murr.—In a forest of oak, sweet birch and red maple, near Mt. Loretto, Staten Island, a red oak (*Quercus rubra* L.), 16 inches in diameter, breast high, had recently been broken about 12 feet from the base and blown over, the freshness of the damage being attested by the wilted, green leaves. Scattered along the surface of the bark from the base of the tree to the breaking point at fairly regular intervals were four fine specimens of this fungus, an organism which is of rare occurrence in North America, and never before found in this locality. From a little distance it resembles a small beehive with one side more or less flattened and cemented firmly to the bark. On closer inspection it may be seen to consist of a large number of small, tightly overlapping, light to very dark gray sporophores of polyporaceous nature, all proceeding from a common center or core (Plate 10, fig. 3).

There is good evidence that the fungus is a facultative parasite, for where the wood was exposed by the break it was covered with a thin sheet of white mycelium which was connected with the sporophores. Investigation showed the heartwood to be infested everywhere with the mycelium, which, in spots, was encroaching on the sapwood also. The fruiting bodies were borne in furrows of the bark, perhaps in regions of old branches. The fungus had apparently gained entrance through a fire scar which extended 18 feet up the trunk.

That the fungus is also saprophytic is shown by collections in the herbarium of the New York Botanical Garden from dead hickory in Indiana, and from a dead stump in Delaware. Other collections at the Garden are from North and South Carolina; from Pennsylvania, Ohio and Iowa. It has been collected on living *Quercus coccinea* at Wilmington, Delaware, by Dail. The specific name was derived from its sweet odor, which, however, was not evident in our specimens.

2. *Inonotus hirsutus* (Scop.) Murr.—The rusty brown or chestnut colored, hairy surface of the pileus of this species, also commonly known as *Polyporus hispidus* Fr., distinguishes it from the nearly related species with a glabrous pileus, *I. dryophilus* (Berk.) Murr., which is the agent of a very destructive heart rot of oaks in the United States.[14] With age the rusty brown color may take on a black, carbonaceous hue, but usually some portion of the pileus still has a ferruginous cast. Moreover, old specimens often lose their dense covering of matted hairs, but are still quite roughened.

A tree of black oak (*Quercus velutina* Lam.) in a forest on Staten Island was found badly diseased, evidently through the action of this fungus. Commencing about 10 feet from the base of the tree were several elongated cankers extending upward for about 8 feet on the trunk and bearing fruiting bodies of the fungus on exposed diseased wood. The trunk was considerably hypertrophied in the region of the cankers, which were fairly close together, and thus a long, spindle-shaped swelling in the bole was formed—a condition which indicated the destruction of the inner wood by the fungus, and an attempted compensation for this by increased growth of the sapwood.

Dr. Murrill says that the species is rare in this country, but common and virulent in Europe and very destructive to shade trees there. The writer collected it on living European ash (*Fraxinus excelsior* L.) near Torquay, Devon, England, in 1915, and also observed it on the same host in 1914 near Rugby, Warwick. According to Prillieux[15] the parasite is not uncommon on mulberry trunks in France. The same investigator and Delacroix record it among the enemies of the English walnut (*Juglans regia* L.) in France.[16] Butler[17] states that it is destructive to

14 Hedgcock, G. G. Notes on some diseases of trees in our national forests. II. Phytopath. 2: 73, 74. 1912.

15 Prillieux, E. Maladies des plantes agricoles 1: 352. 1895.

16 Prillieux, E., and Delacroix, G. Les maladies des noyers en France, Bul. de l'agricult. 1898: 1–14. Ref. in Just's Bot. Jahresb. 26^1: 177. 1898.

17 Butler, E. J. Mulberry diseases. Mem. Dept. Agr. India. Bot. Ser. 2^8: 1–18.

The writer has been able to find no reference to this fungus as a pathogen in the United States.

apples, plums, apricots and especially mulberries in Kashmir, India. It is found in the trunk, but also attacks the larger branches. Butler finds that the fungus enters branch scars where heart-wood is exposed, and says: "The tissues are little by little destroyed from within out, becoming soft, spongy and yellowish white. The trunk may be almost completely hollowed, but often a ring of still living wood is left which is sufficient to keep the crown green." In most cases the trees thus weakened are blown over before they are killed out entirely. This mode of action corresponds closely with the condition of affairs in the oak above described.

3. *Pyropolyporus Everhartii* (Ellis & Gall.) Murr.—A huge pin oak (*Quercus palustris* Muench.) at Englewood Heights, N. J., has attracted a good deal of attention for a number of years on account of numerous gnarly swellings which appear toward the base of the trunk. Each swelling was found to contain in some part of it young or old fruiting bodies of this fungus—also known as *Fomes Everhartii* (Ellis and Gall.) von Schrenk and Spauld.—indicating that the organism was the cause of the disturbance (Plate 10, fig. 1). The fungus had grown in the trunk for a long period of years, if one were to judge from the thickness of the bark and wood of which the swellings were composed.

That this species has parasitic habits has already been pointed out by Von Schrenk and Spaulding,[18] who found it of common occurrence on living black jack oak (*Quercus marilandica* Muench.) and determined that the mycelium of the fungus "was capable of growing into the sapwood of the living tree." Hedgcock[19] finds it causing a very destructive heart rot in a large number of species of oak in the United States and states that it is the cause of the most common and destructive heart rot of walnut, especially *Juglans rupestris,* although *J. nigra* and *J. californica* are frequently attacked. *J. cinerea* is apparently rarely attacked. Other hosts are *Prosopis juliflora* (Swartz) deC. the mesquite, *Fagus atropunicea* (Marsh.) Sudw. the beech, *Betula papyrifera*

[18] Von Schrenk, H., and Spaulding, P. Diseases of deciduous forest trees. U. S. Dept. Agr. Bur. Plant Ind. Bul. 149, p. 48. 1909.

[19] Hedgcock, G. G. L. c. pp. 74, 75.

Marsh, the paper birch, and other species of birch. Weir[20] records it on living trunks of *Populus trichocarpa* Torr. & Gr., the black cottonwood, in Montana.

The sporophores resemble closely those of *Pyropolyporus* (*Fomes*) *igniarius* (L.) Murr., but the spores of the latter are colorless, while those of this species are yellowish brown. Another distinctive feature seems to be the bright yellow color of the mycelium of which the pileus is composed. Dr. Murrill says that he also has used this bright color as a field character.

V. DISEASE OF THE WHITE OAK (*Quercus alba* L.)

All over Staten Island the white oaks of large size were found to be dying out. This was not due to the severe winter preceding, for Dr. Arthur Hollick, of the Staten Island Institute of Arts and Sciences, informed the writer that the trouble has been going on for several years. There was no patch of forest in which the dying and dead trees could not be seen on every hand. Rhizomorphs (possibly of *Armillaria mellea* (Vahl.) Quélet) were found under the bark of many, but not all trees. It seemed as if the larger trees were the ones that were affected. In some instances traces of a boring beetle were seen.

VI. BARK DISEASE OF THE PAPER MULBERRY (*Broussonetia papyrifera* Vent.)

Near Bayside, L. I., a large paper mulberry about one foot in diameter breast high, growing as a shade tree in a front yard, was found badly diseased by *Creonectria purpurea* (L.) Seaver (*Nectria cinnabarina* Fr.) at the base of the trunk. The potential pathogenicity of this species has been proven beyond question,[21] and there was no doubt here that the fungus was advancing in the living bark. And yet it is known to often lead a purely saprophytic life on dead twigs.

[20] Weir, J. R. Montana forest tree fungi I. Polyporaceae. Mycologia **9**: 135. 1917.

[21] Mayr, H. Über den Parasitismus von Nectria cinnabarina. Untersuch. a. d. Forstb. Inst. zu München. III. 1882

VII. Blight of Sycamore (*Platanus occidentalis* L.)

The blight of sycamore, caused by *Gnomonia veneta* (Sacc. & Speg.) Kleb. was seen in many places: practically no sycamore was free from it. The fungus appears to be a slow parasite, growing more especially during the early spring months during the period of dormancy of the host. When observed during the summer, the fungus had in all cases apparently ceased its growth, after killing terminal twigs here and there. This habit is probably largely responsible for the scraggly appearance of our sycamore trees.

VIII. Heart Rot of Locust (*Robinia pseudacacia* L.)

The black locust is very common in the area under consideration, especially on Long Island. Its worst fungous enemy is *Pyropolyporus Robiniae* Murrill, which attacks the heart-wood.[22] The fruiting bodies are large, hoof-shaped structures, and are of common occurrence but do not attract attention because they are dark colored and usually high up on the trunk.

During the summer the depredations caused by the locust leaf miner (*Chalepis dorsalis* Thunb.) were conspicuous.

IX. Injury from the Winter Conditions of 1917–18

In an account of the most important and interesting pathological features of the trees in the New York region, the effects of the severe winter of 1917–18 should by no means be omitted. It is entirely unnecessary for the writer to establish the fact that the winter was unprecedented, for that was perfectly clear to all at the time. What he would like to emphasize is that the combination or the chain of meteorological phenomena, aside from the mere fact of the extreme cold itself, was especially unfavorable for plant life. This cannot be better set forth than by quoting from Dr. Taylor.[23] After remarking on the extremely low temperatures toward the latter part of December, he con-

[22] Schrenk, H. von. A disease of the black locust. Mo. Bot. Gard. Rept. 12: 21–31. 1901.

[23] Taylor, N. Effects of the severe winter on the woody plants in the garden. Brooklyn Botanic Gard. Record 7: 83–87. 1918.

tinues as follows: "The first four days of the year showed minimum temperatures of $-5°$, $+2°$, $0°$, and $-3°$ respectively, and on January 12 the temperature was 50°. Worst of all, on the latter day, the velocity of the wind was greater here than in any other place in the country, the record showing maximum velocity of 84 miles an hour, from the southeast. The following of such extreme cold by a warm wind of this great velocity apparently played havoc with many valuable plants in the Garden. With the ground frozen to depths unknown before, as there was practically no snow covering during the coldest days, the root activity of most plants would be stopped, while the warm wind on the twelfth, when the maximum temperature for January was recorded, would dry out many evergreens, even if they had withstood the cold of a few days before. Because of this combination of cold temperatures followed by warm wind, it is perhaps impossible to ascribe all our losses to cold alone. Certainly one or the other, or most probably their combination, has had disastrous results. . . ."

Taylor found that in the Brooklyn Botanic Garden 28 kinds of plants were killed outright, 20 killed to the ground, 70 severely winter-killed, and 28 slightly winter-killed.

In Central Park, the writer saw hundreds of trees which had suffered severely from these conditions, some killed outright, and most of them damaged beyond possible recovery. Prominent among the victims were large numbers of handsome beeches, sycamore maples, silver, red and Norway maples, cut-leaved birches, white mulberry, sassafras, black cherry, American elm, basswood, Turkey and pin oaks, and many others. Along the walk south of the reservoir, which was exposed to the full force of a north wind across the water, nearly every tree was dead or dying. Horsechestnuts and oriental planes seemed to stand the test as well as any species.

The following points should dispel any doubt that the winter was responsible for these conditions:

1. A large *variety* of species was affected.
2. The worst destruction appeared in exposed localities.
3. The symptoms were characteristic of winter injury; i. e.,

a browning of the leaves, casting of the leaves, and developing of suckers.

That the damage was so extensive in Central Park is to be accounted for partly by the character of the soil, which for the most part is hard and packed with the tramp of many feet. This condition, coupled with the absence of leaf mulch, rendered both radiation and evaporation more rapid from the surface, and therefore cold and drought penetrated much more readily and deeply than would be the case in the normal forest, where the soil is a deep rich humus covered with a blanket of decaying leaves.

Of susceptible species noted in other places, the sweet cherry, *Prunus avium* L., was the most conspicuous, and trees of this species killed outright were a very common sight. *Liquidambar* trees at Mt. St. Vincent and on Long Island were also notable sufferers. Many *Ailanthus* trees and especially the Lombardy poplar—the latter in the marginal park between the Hudson and Riverside Drive—were entirely killed. It is interesting to recall that *Liquidambar* is here near the northern limit of its range.

NEW HAVEN,
CONNECTICUT.

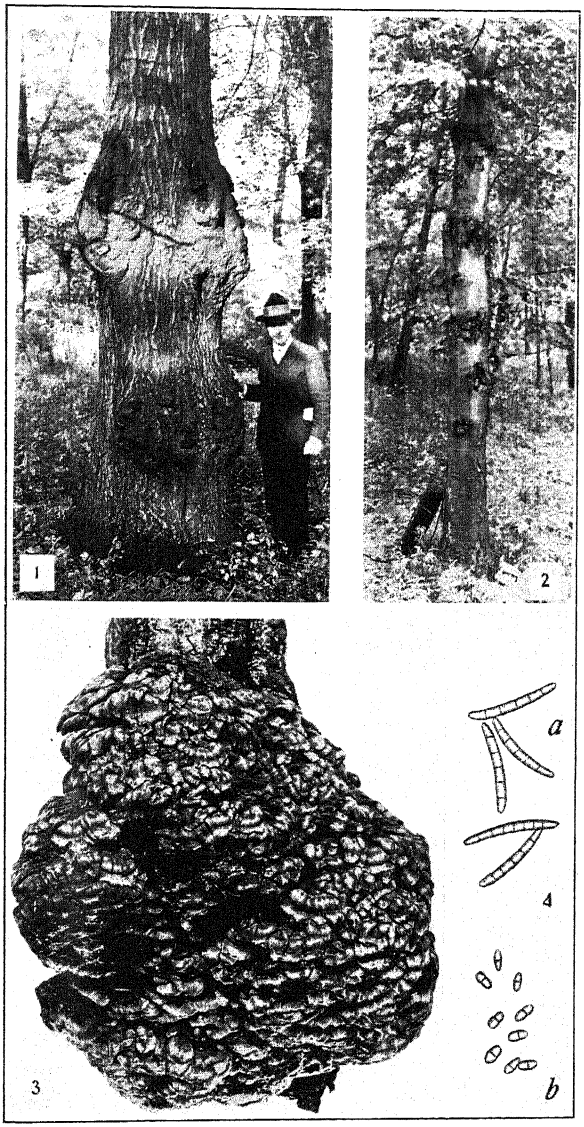
EXPLANATION OF PLATE

Fig. 1. Pin oak (*Quercus palustris* Muench.) at Englewood Heights, N. J., showing cankerous growths caused by *Pyropolyporus Everhartii* (Ellis & Gall.) Murr. This and the following photographs taken by Mr. Louis Buhle, Brooklyn Botanic Garden.

Fig. 2. Sweet birch (*Betula lenta* L.) with canker caused by *Creonectria coccinea* (Pers.) Seaver. On terminal moraine north of Hollis, L. I.

Fig. 3. Fruiting body of *Globifomes graveolens* (Schw.) Murr. from living red oak (*Quercus rubra* L.) in a forest near Mt. Loretto, Staten Island. One half natural size.

Fig. 4. Spores of *Creonectria coccinea* (Pers.) Seaver. *a*, macroconidia; *b*, ascospores. × about 300.



1. PYROPOLYPORUS EVERHARTII (ELLIS & GALL.) MURRILL
2, 4. CREONECTRIA COCCINEA (PERS.) SEAVER
3. GLOBIFOMES GRAVEOLENS (SCHW.) MURRILL

A NOVEL METHOD OF ASCOSPORE DISCHARGE

D. Atanasoff

It has been generally observed that ascospores are discharged commonly from the apex of the ascus which ruptures at this point just before the ascospores are liberated. A few forms, such as *Claviceps,* have also been reported where the ascospores are discharged through the lower end of the ascus when it is torn from the perithecial base. A still different method of ascospore discharge, however, has recently been observed in certain *Pyrenophora* species. These have developed on the leaves and stems of *Bromus* and *Agyropyron repens* which earlier showed *Helminthosporium* lesions and are regarded as the perfect stages of these *Helminthosporium* species. *Pleospora herbarum* (Pers.) Rab., studied on various hosts has shown the same phenomenon. In these cases, the ascospore discharge is preceded by a modification of the ascus and the spores are then liberated from the side of the ascus.

Upon placing a mature perithecium having fully developed asci and ascospores in a drop of water on a microscope slide, the asci are readily liberated by slight pressure upon the perithecium wall and the ascospore discharge can be studied under the low power lens. The ascus wall in these species consists of two layers, the outer of which is thinner but more firm; the inner, much thicker and less firm. These two walls are not distinguishable, however, until the moment of ascospore discharge. When the ascus is liberated from the perithecium it begins to imbibe water. This seems to take place so rapidly that in a few seconds the ascus swells to one and one half times its original size. The pressure on the outer wall soon becomes so great that the latter ruptures at the apex of the ascus, contracts, and slips down toward the base with great rapidity. In some cases, however, all of this occurs less rapidly and can be easily followed under the micro-

scope. The ruptured outer wall contracts both in length and width. Soon the outer wall contracts at a point about one third of the distance up from the base of the ascus, thus forming a ring, while the ascus continues to swell by taking in more water. The pressure, partly released after the rupture of the outer wall,

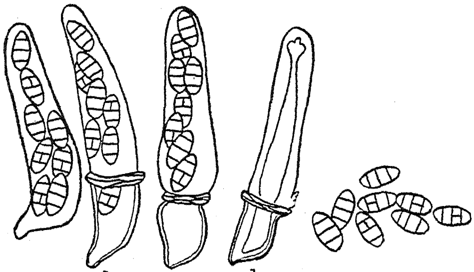


Fig. 1. Camera lucida drawing of an ascus of *Pyrenophora* in different stages of ascospore discharge, showing: *a*, normal ascus immediately after leaving the perithecium; *b*, outer wall ruptured and contracted in form of ring; *c*, ascus with all ascospores above the ring, pressure in ascus nearing critical point; *d*, discharged ascus with ascospores lying as thrown from ascus.

continues to increase until it reaches the critical point once more; the inner wall then ruptures, not at the apex, but just above the ring formed by the contracted outer wall, and the spores are thrown out with great force. Because of the resistance of the

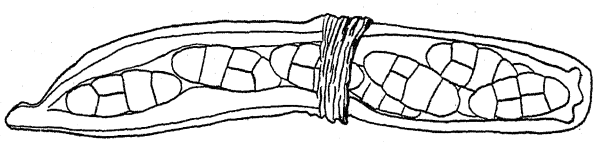


Fig. 2. Camera lucida drawing of ascus under high power, showing the two ascus walls, the outer ruptured and partially contracted, the inner much thickened and pressing upon the ascospores especially in the lower part.

water, they usually remain near the point of rupture of the inner wall, but that they are thrown out with great force is shown by the rapidity of their motion which is so great that it is very difficult to follow their exit from the ascus. The rapid shrinking of the empty ascus after the discharge of spores corroborates this point.

The ascospores before and during the swelling of the ascus are distributed uniformly throughout the ascus. After the formation of the ring, however, partly because of the rupturing and contraction of the outer wall, but more particularly because of the thickening of the inner wall, especially in the lower part of the ascus, there seems to be an upward movement of the ascus contents and usually before the breaking of the inner wall all ascospores are above the ring. Occasionally it was observed that single spores remained below the ring, but such spores usually remain inside the ascus even after the breaking of the inner wall.

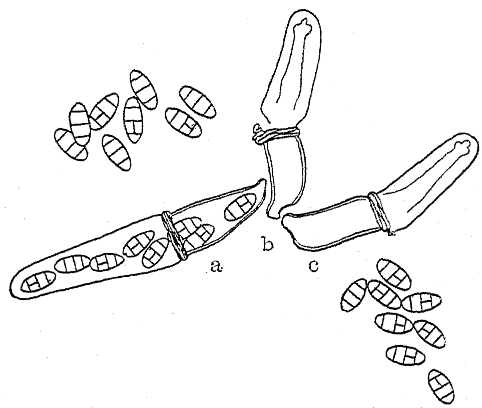


Fig. 3. Camera lucida drawing of group of asci, showing: *a*, swollen ascus with contracting outer wall; *b* and *c*, ruptured asci with ascospores lying as discharged.

Only in very rare cases, mostly in improperly developed asci, are there any spores left in the upper part of the ascus after the breaking of the inner wall.

The time that elapses from the moment of the liberation of the ascus from the perithecium to the time of its swelling and the rupturing of the outer wall varies considerably. It may take only a few seconds (15–30) or even several minutes or longer. The length of the time that elapses from the rupturing of the outer wall to the rupturing of the inner wall varies also. In some cases it is less than 30 seconds; in others it may be as long as 30 minutes.

Pfeffer in his "Physiology of Plants," 2d edition, v. 3, pp. 149–150, fig. 34, has described a case of ascospore discharge which resembles the above only in the behavior of the outer wall. Here the inner wall, instead of breaking above the ring formed by the outer wall, breaks at the top, and the spores are discharged not all at once but one by one. First one spore takes its place immediately at the apex, the inner wall breaks at that point, and the spore is thrown out. The next spore closes the opening of the inner wall and remains there until the pressure inside of the ascus becomes great enough to cause ejection. After this spore is thrown out, the next one takes its place and so on.

The method of ascospore discharge described here for some *Pyrenophora* and *Pleospora* species is the only method of ascospore discharge observed by the writer for these fungi. The material studied was gathered at different times throughout the spring and summer of 1918, and also during the early part of February, 1919, from different localities around Madison, Wis.

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CULTURES OF HETEROECIOUS RUSTS IN 1918

W. P. FRASER

While making a field survey in western Canada of the rusts which attack cereals, a number of grass and sedge rusts were collected, and a few cultures which field observations suggested were undertaken. These cultures were carried on in a well-lighted room in the Dominion Laboratory at Brandon, Man.

The methods of inoculation were those commonly employed. When teliosporic material was used it was placed in a moist chamber until the teliospores were germinating, when it was suspended above the plants used in the cultures. The plants and teliosporic material were then sprayed with water by means of an atomizer and covered with a bell jar for about 48 hours. When aesciosporic material was used the fresh aesciospores were transferred with a flat needle to the leaves of the culture plants and in addition the parts bearing aecia were suspended above so that the aesciospores would fall on the plants used in the culture. They were then sprayed and covered with a bell jar as in the case of the teliosporic experiments. Checks were kept which in all cases remained free from infection.

UROMYCES ALOPECURI Seym.

Aecia on *Ranunculus Macounii* Britton were often found associated with this rust on *Alopecurus aristulatus* Michx., so that the connection of the aecia was clearly indicated. On June 16th, two pots of *Alopecurus aristulatus* and one each of *Agropyron tenerum* Vasey and *Hordeum jubatum* L. were inoculated with fresh aeciospores collected at Brandon, Man. Uredinia began to appear on the pots of *Alopecurus* on June 23, and eventually aeciospores developed abundantly, followed later by telia. There was no infection of the other grasses. Collections of aecia were

also made on *Ranunculus sceleratus* L. in the vicinity of the rusted *Alopecurus* which doubtless belong here.

Orton (Mycol. 4: 194. 1912) discusses the correlation between certain species of *Puccinia* and *Uromyces* and gives a number of examples of correlated species. *Uromyces Alopecurus* is clearly correlated with *Puccinia perplexans* Plow. (now usually placed with *Puccinia Agropyri* E. & E.) on *Alopecurus pratensis* L. Cultures by the writer (Mycol. 4: 179. 1912) showed that *Puccinia perplexans* has aecia on *Ranunculus acris* L.

PUCCINIA ANGUSTATA Peck

Observations in the field clearly indicated that aecia on *Mentha canadensis* L. were connected with a rust on *Scirpus atrovirens* Muhl. Viable teliosporic material was collected at Brandon in the spring and two pots of *Mentha canadensis* were inoculated on May 28. Pycnia became evident on June 3 and aecia on June 10, infection being very abundant. Dr. Arthur determined the rust as *Puccinia angustata* Peck and pointed out that the aecia had been confused with the aecia of *Puccinia Menthae* Pers. notwithstanding they are much smaller and paler in color. Collections of aecia on *Mentha canadensis* belonging to this species were made later in the season at Dauphin, Man., where they were quite common.

Dr. Arthur has shown many times that this rust also has aecia on *Lycopus* (Bot. Gaz. **35**: 15, 21. 1903. Jour. Mycol. **8**: 53, 54. 1902, **11**: 58. 1905; **12**: 15. 1906; **14**: 13. 1908. Mycol. **1**: 223. 1909; **2**: 224. 1910; **4**: 54. 1912; **7**: 70. 1915). This experiment, however, establishes for the first time connection with aecia on *Mentha*.

PUCCINIA PHRAGMITIS (Schum.) Koern.

This rust was collected on *Phragmites communis* Trin. at Dauphin, Man. Wintered teliosporic material gave excellent germination and inoculations were made on plants of *Rumex*. Pycnia and aecia developed in abundance. The species of *Rumex* used in the culture could not be determined but it probably was *R. occidentalis* Wats. Collections of aecia were made

on *Rumex occidentalis* Wats. and *R. mexicanus* Meisn. in the field in the vicinity of the rusted *Phragmites* which belong to this species. Dr. Arthur (Bot. Gaz. **29**: 269. 1909. Jour. Mycol. **9**: 220. 1903; **14**: 15. 1908. Mycol. **2**: 225. 1910; **4**: 54. 1912) has conducted several successful cultures with this species.

PUCCINIA IMPATIENTIS (Schw.) Arth.

Aecia were found abundantly on *Impatiens biflora* Walt. at Dauphin, Man., and field evidence strongly suggested their connection with a rust on *Hordeum jubatum* L. On July 15 three pots of *Horedum jubatum* and one of *Triticum vulgare* L. were inoculated with fresh aeciospores. Uredinia were noticed on all the pots of *Hordeum jubatum* on July 25 and an abundant development of urediniospores followed. Telia began to form on August 2. The leaves of wheat flecked but there was no development of uredinia.

Further study is necessary to determine the systematic position of this rust, but it seems best for the present to place it with *Puccinia impatientis* which Arthur (Bot. Gaz. **35**. 18. 1903. Jour. Mycol. **10**: 11. 1904; **11**: 57. 1905. Mycol. **2**: 226. 1910) has shown to have aecia on *Impatiens* and telia on *Elymus*. It is very common on *Hordeum jubatum* in northern Manitoba.

PUCCINIA AGROPYRI E. & E.

In the vicinity of Brandon in many places aecia were common on species of *Thalictrum*. Field evidence indicated very strongly their connection with a sub-epidermal rust on *Bromus ciliatus* L. and B. *latiglumis* (Shear) Hitchc. There was also some evidence of connection with *Puccinia Agropyri* E. & E. on species of *Elymus* and *Agropyron*. On June 18 inoculations were made with aesciospores from *Thalictrum dasycarpum* Fisch. & All. collected at Brandon on the following grasses: *Elymus canadensis* L., *E. virginicus* L., *Agropyron tenerum* Vasey, *A. Richardsonii* Schrad., *Hordeum jubatum* L. and *Triticum vulgare* L. Uredinia appeared on *E. canadensis* on June 30, followed by telia on July 20. On *E. virginicus* uredinia were noticed on June 28 and telia by

July 11. *Hordeum jubatum* showed a slight infection, uredinia appearing on July 3, but telia were not formed, the plants not being healthy. There was no infection of the other grasses. On June 24, *Bromus ciliatus* was inoculated and uredinia were noticed on July 3 and telia by July 8, both were produced in great abundance.

Examination showed the rust on *Bromus,* both the field and culture collections, to possess teliospores very variable in size, shape and number of cells, only rarely could two-celled spores of the *Puccinia* type be found, practically all of the spores being three to several celled, some having as many as sixteen cells. The teliospores on *Elymus* were typical of *Puccinia Agropyri,* both those developed from the culture and field collections, though a few were three or more celled.

As Long (Jour. Agr. Res. **2**: 303. 1914) has shown that the host plant affects the morphological character of the spores in *Puccinia Ellisiana* Thuem. it was thought possible that the rust on *Bromus* and *Elymus* might be identical though showing such marked morphological differences in the teliospores. To test this, inoculations were made with the urediniospores from the culture on *Bromus ciliatus* on the following grasses: *Elymus virginicus* L., *Agropyron tenerum* Vasey, *A. Smithii* Rydb., *A. repens* (L.) Beauv. and *Hordeum jubatum* L. There was no infection of any of the grasses so it seems probable that the form of *Bromus* is biologically distinct, and that the plants of *Thalictrum* used in the culture bore two kinds or strains of aecia, one capable of infecting *Bromus* and another which infected *Elymus, Agropyron* and *Hordeum.*

Trelease (Jour. Mycol. **1**: 14. 1885) described a subepidermal rust on *Bromus* as *Puccinia tomipara* Trel. on account of some of the teliospores being three to several celled. Lagerheim placed this species in the genus *Rostrupia* on account of the several celled teliospores. Arthur (Mycol. **7**: 74. 1915) regards the group of subepidermal forms passing under various names with telia chiefly on *Agropyron, Elymus* and *Bromus* and aecia on Ranunculaceous hosts as forming one species. This includes *Puccinia tomipara* Trel.

The marked morphological departure from the *Puccinia* type by the teliospores of the *Bromus* rust used in the culture, make it doubtful whether it should be included in the genus *Puccinia.* The character seems fixed as many collections made at Brandon showed this character, as well as collections made on *Bromus latiglumis* (Shear) Hitchc. at Brandon, and Morris, Man. As its other characters and life cycle show a close relation with *Puccinia Agropyri,* it seems best to include it here until further study determines its true position.

SUMMARY

Uromyces Alopecuri Seym. Aeciospores from *Ranunculus Macounii* Britton infected *Alopecurus aristulatus* Michx.

Puccinia angustata Peck. Teliospores from *Scirpus atrovirens* Muhl. infected *Mentha canadensis* L.

Puccinia Impatientis (Schw.) Arth. Aeciospores from *Impatiens biflora* Walt. infected *Hordeum jubatum* L.

Puccinia Phragmitis (Schum.) Koern. Teliospores from *Phragmitis communis* Trin. infected *Rumex* Sp.

Puccinia Agropyri E. & E. Aecispores from *Thalictrum dasycarpum* Fisch. & All. infected *Elymus canadensis* L., *E. virginicus* L., *Hordeum jubatum* L. and *Bromus ciliatus* L. Uredospores from *Bromus ciliatus* L. failed to infect *Elymus virginicus* L., *Agropyron Smithii* Rydb., *A. tenerum* Vasey, *A. repens* (L.) Beauv. and *Hordeum jubatum* L.

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NORTH AMERICAN RUSTS ON CYPERUS AND ELEOCHARIS[1]

Frank D. Kern

The rusts inhabiting the species of the genus *Carex* have received considerable attention from both taxonomic and cultural viewpoints. The most recent accounts recognize in North America twenty-three species of *Carex* rusts, four with 1-celled teliospores (*Uromyces* or *Nigredo* type)[2] and nineteen with 2-celled teliospores (*Puccinia* or *Dicaeoma* type).[3] The rusts of other sedges have been studied much less carefully. Although *Cyperus* and *Eleocharis* are smaller and less variable genera than *Carex* it has not seemed reasonable that their rust flora should be so much more meager in North America as to consist of but three species on the two genera, yet this has been the generally accepted situation up to the present time. All specimens of rust on *Cyperus* have been called *Puccinia Cyperi* or *P. canaliculata,* these names being considered synonymous, while on *Eleocharis* 1-celled teliosporic forms have been called *Uromyces Eleocharidis,* and 2-celled forms *Puccinia Eleocharidis.*

Cyperus is a genus of about 600 species with a considerable distribution in the tropics whereas the genus *Carex* has something over 1,000 species chiefly distributed in temperate regions. *Eleocharis* is a much smaller genus. It is made up of about 140 species, rather widely distributed.

With the facts in mind as to the relative importance of the genera *Cyperus* and *Eleocharis* it was anticipated that a careful study of their rusts would reveal the presence of some additional

[1] Read before the joint session of the Botanical Society of America and American Phytopathological Society, Baltimore meeting, Dec. 27, 1918. Contribution from the Department of Botany, Purdue University Agricultural Experiment Station, and from the Department of Botany, The Pennsylvania State College, No. 15.

[2] North American Flora 7: 234–236. 1912.

[3] Mycologia 9: 205–238. 1917.

species. There have been available about 300 collections (211 on *Cyperus* and 82 on *Eleocharis*) from the United States, Mexico, Central America, and the West Indies. Advantage was taken of an opportunity during the spring of 1918, to work in the Arthur Herbarium, Purdue University Agricultural Experiment Station, and the facilities provided by Professor H. S. Jackson, the advice of Dr. J. C. Arthur, and the aid rendered by several assistants, particularly Misses Evelyn Allison and Grace Wineland, and Mr. H. R. Rosen, have been in a large measure responsible for the results attained. Especial thanks are due Mr. Rosen for painstaking microscopic studies which were of the greatest value in defining the limits of the species. Type specimens of the new species are in the Arthur Herbarium.

About a dozen species of rust have been described on *Cyperus*. Five species are recognized in this paper. Four of the several possible names are applicable and one new name is proposed. Some of the established names are included in the synonomy and four are excluded. They either represent species not in our range or sufficient information is lacking to permit a proper disposition. An annotated list of these is included. No 1-celled teliosporic form has been described on *Cyperus*. Fewer species of rust have been described on *Eleocharis*. In North America we have known two, as many more are described here. Much culture work needs to be done. Only two of the nine species have their aecial stages known and two are known in the uredinial stage only.

KEY

HOSTS BELONGING TO GENUS CYPERUS (OR KYLLINGA).

Urediniospore-pores 2, equatorial.

Urediniospore-wall 1–2 µ thick, uniform.

1. *Puccinia canaliculata.*

Urediniospore-wall 1.5–2.5 µ thick, frequently thicker above.

2. *Puccinia Cyperi-tagetiformis.*

Urediniospore-pores usually 3 (in occasional spores 4 or 2), equatorial.

Urediniospore-wall 1.5 µ, or less, thick.

Urediniospore-wall nearly colorless, teliospore-wall 1.5–3 µ above.

3. *Puccinia antioquiensis.*

Urediniospore-wall cinnamon-brown, teliospore-wall 3–5 µ above.

4. *Puccinia abrepta.*

Urediniospore-wall 1.5–2 µ thick, teliospore-wall 7–12 µ above.

5. *Puccinia Cyperi.*

HOST BELONGING TO GENUS ELEOCHARIS.
Teliospores 2-celled.
Urediniospore-pores 2, equatorial.
Urediniospores small, 13–21 × 18–27 μ.
6. *Puccinia liberta.*
Urediniospores large, 18–26 × 27–37 μ.
7. *Uredo incomposita.*
Urediniospore-pores usually 4 (in occasional spores 3 or 5), equatorial.
8. *Puccinia Eleocharidis.*
Teliospores 1-celled. 9. *Uromyces Eleocharidis.*

1. PUCCINIA CANALICULATA (Schw.) Lagerh. Trömso Mus. Aarsh. **17**: 51. 1894

Sphaeria canaliculata Schw. Trans. Am. Phil. Soc. II. **4**: 209. 1832.
Aecidium compositarum Xanthii Ellis, N. Am. Fungi *1018b*. 1883.
Aecidium compositarum Ambrosiae Burrill; DeToni, in Sacc. Syll. Fung. **7**: 798. 1888.
Aecidium compositarum Xanthii Burrill; DeToni, in Sacc. Syll. Fung. **7**: 799. 1888.
Puccinia cellulosa B. & C.; Cooke, in Grevillea **20**: 108. 1892.
Uredo ustulata B. & C.; Cooke, in Grevillea **20**: 110, hyponym. 1892.
Puccinia nigrovelata Ellis & Tracy; Ellis & Ev. in Bull. Torrey Club **22**: 60. 1895.
Dicaeoma canaliculatum Kuntze, Rev. Gen. 3^3 466. 1898.
Dicaeoma nigrovelata Kuntze, Rev. Gen. 3^3: 469. 1898.

O. Pycnia amphigenous, gregarious, in small compact groups, honey-yellow becoming brownish, inconspicuous, globoid, 112–128 μ in diameter; ostiolar filaments up to 35 μ or more long.

I. Aecia chiefly hypophyllous, in orbicular or elongated groups 2–5 mm. or more across, on larger discolored spots or on swollen areas on the stems, cupulate, low, 0.2–0.3 mm. in diameter; peridium delicate, the margin finely eroded and slightly recurved; peridial cells rhomboidal, 23–29 μ long, slightly overlapping, the outer wall thick, 5–8 μ, striate, the inner wall thinner, 2–4 μ, verrucose; aeciospores globoid, often angular, 13–16 by 15–19 μ; the wall thin, 1 μ or less, finely verrucose.

ON AMBROSIACEAE:

Ambrosia trifida L., Indiana, Missouri.
Xanthium sp., Arkansas, Delaware, Indiana, Iowa, New Mexico, Pennsylvania.

II. Uredinia chiefly hypophyllous, scattered, oblong, 0.5–2 mm. long, tardily dehiscent by longitudinal slits, ruptured epidermis conspicuous, somewhat pulverulent, cinnamon-brown; urediniospores broadly ellipsoid or obovoid, 13–19 by 19–29 μ; the wall yellowish or cinnamon-brown, 1–2 μ thick, moderately and finely echinulate; the pores 2, equatorial.

III. Telia chiefly hypophyllous, scattered or more often confluent in groups 1–3 mm. or more long, individual sori linear, 0.1 mm. or less in width and surrounded by well developed brownish stroma, blackish or grayish-black, long covered by the epidermis, not or only slightly raised above the leaf surface; teliospores clavate-oblong, 15–21 by 39–64 μ, acuminate, obtuse or rounded above, narrowed below, slightly or not constricted at septum; the wall dark cinnamon-brown, lighter toward base, about 1 μ thick, much thicker above, 3–10 μ; pedicel short, tinted.

ON CYPERACEAE:

Cyperus cylindricus (Ell.) Britton (*C. Torreyi* Britton), Delaware.

Cyperus esculentus L., California, District of Columbia, Florida, Indiana, Kansas, Michigan, Nebraska, New Jersey, New Mexico, Oklahoma, Texas; Mexico (state), Toluca.

Cyperus fendlerianus Boeckl., New Mexico.

Cyperus ferax L. C. Rich, Cuba; Porto Rico.

Cyperus giganteum Vahl, Porto Rico.

Cyperus Hallii Britton, Missouri.

Cyperus Houghtonii Torrey, Nebraska, Wisconsin.

Cyperus Mutisii (H.B.K.) Griseb., Jamaica.

Cyperus reticulatus L., Porto Rico.

Cyperus rotundus L., Florida, Kansas.

Cyperus seslerioides H.B.K., Mexico (state).

Cyperus speciosus Vahl, Kansas.

Cyperus strigosus L., Alabama, Delaware, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Mississippi, Nebraska, New York, Oklahoma, Pennsylvania, Virginia, West Virginia.

Cyperus surinamensis Rottb. (?), Texas; Cuba.

Cyperus thyrsiflorus Jung. (?), Mexico (state).

Cyperus sp., Colorado, North Carolina, Guatemala; Oaxaca.

Type locality: Bethlehem, Pennsylvania, on *Cyperus* sp.

Distribution: New York to Michigan and Nebraska south through Mexico, Central America and the West Indies.

Exsiccati: Barth. Fungi Columb. *2449, 2758, 4260;* Barth. N. Am. Ured. *136, 137, 233, 337, 839, 1038, 1430, 1637;* Carleton, Ured. Am. *10;* Ellis, N. Fungi *1018b;* Ellis & Ev. Fungi Columb. *552, 983, 1760, 2144, 2146;* Ellis & Ev. N. Am. Fungi *3143, 3352;* Seym. & Earle, Econ. Fungi *393*.

A comparison of the types of *Puccinia canaliculata* Schw. and *P. Cyperi* Arth. shows clearly that they are distinct species. The presence of a strongly developed stroma in the telia of *P. canaliculata* and a lack of a similar development in *P. Cyperi* is one of the most conspicuous differences. There are also other distinguishing characters in the telia. In *P. canaliculata* the telia are not much raised above the surface and the epidermis does not rupture noticeably whereas in the other species the telia are pulvinate and the ruptured epidermis becomes conspicuous. Important differences in the urediniospores particularly in size of the spores and arrangement of pores help to make the separation of the two species unquestionable. This is the only *Cyperus* rust which has been cultured. For record of first cultures see Journal of Mycology **12**: 23. 1906.

2. **Puccinia Cyperi-tagetiformis** (P. Henn.) comb. nov.

Uredo Cyperi-tagetiformis P. Henn. Engler's Bot. Jahrb. **34**: 598. 1905.

O and I. Pycnia and aecia unknown.

II. Uredinia hypophyllous and culmicolous, scattered, oblong, 0.5–2 mm. long, tardily dehiscent by longitudinal slits, bullate, finely pulverulent, cinnamon-brown; urediniospores broadly ellipsoid or slightly obovoid, 15–21 by 19–26 μ; the wall dark cinnamon-brown or somewhat lighter, 1.5–2.5 μ thick, frequently thicker and lighter at apex, up to 3 μ, verrucose or verrucose-echinulate, the markings more pronounced above, the pores 2, equatorial.

III. Telia chiefly hypophyllous, most often confluent in groups 1–4 mm. or more long, individual sori linear, about 0.1 mm. in width, surrounded by well developed brownish stroma, blackish-brown, long covered by the epidermis, not much raised above the

leaf surface; teliospores clavate-oblong, 14–18 by 31–48 μ acuminate, obtuse or rounded above, narrowed below, slightly constricted at septum; the wall golden or light cinnamon-brown, about 1 μ thick, much thicker above, 6–10 μ; pedicel short, slightly tinted.

ON CYPERACEAE:

Cyperus distans L., Porto Rico.
Cyperus flavicomus Michx., Texas.
Cyperus laevigatus L., Porto Rico.
Cyperus odoratus L., Cuba; Porto Rico.
Cyperus polystachys Rottb., Porto Rico.
Cyperus radiatus Vahl, Porto Rico.
Cyperus sphacelatus Rottb., Porto Rico.
Cyperus surinamensis Rottb., Porto Rico.

Type locality: Kamodamura, Tosa, Japan, on *Cyperus tagetiformis.*

Distribution: Southeastern Texas and the West Indies.

When described this species was known in the uredinial stage only. Teliospores have been found since which are of the 2-celled type. The urediniospore-pore arrangement is similar to the preceding species but the thicker walls of the urediniospores which are frequently thicker and lighter at the apex are very distinctive characters. Except for a single specimen from Texas the distribution in our range is limited to Porto Rico.

3. PUCCINIA ANTIOQUIENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 473. 1913

O and I. Pycnia and aecia unknown.

II. Uredinia amphigenous and caulicolous, scattered, small, punctiform or somewhat oblong, long covered by the epidermis; urediniospores broadly ellipsoid or obovoid, 14–19 by 18–26 μ; the wall nearly colorless or pale yellow, thin, about 1 μ minutely and sparsely echinulate; the pores obscure, apparently 3, equatorial.

III. Telia caulicolous or hypophyllous, scattered, rounded or slightly elongated, long covered by the epidermis, finally dehiscent and somewhat pulverulent; teliospores clavate-oblong, 11–16 by 35–50 μ, rounded, truncate or somewhat acuminate at apex, attenuate at base, slightly or not constricted at septum; the wall

golden- or light cinnamon-brown, paler below, very thin, about 1 μ, thicker at apex, 1.5–5 μ, smooth; pedicel about half length of spore, slightly tinted.

ON CYPERACEAE:

Cyperus diffusus Vahl, Panama.

Type locality: Antioquia, Columbia, on *Cyperus diffusus.*

Distribution: Panama; also in South America.

Puccinia antioquiensis as described by Mayor from Columbia is a decidedly characteristic species. The pale thin walls of both urediniospores and teliospores, and the slight thickness at the apex of the teliospores, put the species in a class by itself. Our specimen from Panama is on the same host as the type specimen and agrees perfectly in all respects.

4. **Puccinia abrepta** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia hypophyllous, scattered, oval or oblong, 0.3–1 mm. long, somewhat bullate, rather tardily naked, ruptured epidermis conspicuous, cinnamon-brown; urediniospores ellipsoid or obovoid, 16–19 by 23–26 μ; the wall cinnamon-brown, 1–1.5 μ thick, moderately or sparsely echinulate; the pores 3, equatorial, covered with a swollen hyaline cuticle.

III. Telia not seen; teliospores narrowly ellipsoid or oblong, 13–16 by 27–45 μ, rounded above and slightly narrowed below, somewhat constricted at septum; the wall light cinnamon-brown, thin, 1 μ or less, thicker above, 3–5 μ, smooth; pedicel about one-half length of spore, tinted.

ON CYPERACEAE:

Cyperus ferax L. C. Rich, Costa Rica.

Type collected at San Jose, Costa Rica, Jan. 8, 1916, *E. W. D. Holway 385.*

Distribution: Known only from the type locality.

The specimen here used as the basis of a new species differs from *Puccinia antioquiensis* in the darker, thicker-walled urediniospores and in the thicker apex of the teliospores. It differs from *Puccinia Cyperi* particularly in the smaller size of the urediniospores and in the thinner apex of the teliospores. The host of the

type was determined by P. C. Standley. The specimen was reported by Arthur in the Costa Rican list of Uredinales as *P. canaliculata*.[4]

5. PUCCINIA CYPERI Arth. Bot. Gaz. **16**: 226. 1891

Dicaeoma Cyperi Kuntze, Rev. Gen. 3^3: 466. 1898.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly hypophyllous, scattered, often very numerous, oblong, 0.3–1.5 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate; urediniospores ellipsoid or obovoid, 18–24 by 24–35 μ; wall light cinnamon-brown, 1.5–2 μ thick, moderately and finely echinulate; the pores equatorial, usually 3, in occasional spores 4 or 2.

III. Telia chiefly hypophyllous, in groups 1.6 mm. long, or scattered, individual sori linear 0.1–0.2 mm. in width, with no or only slight development of stroma, somewhat tardily naked, dark chocolate-brown or blackish, pulvinate, ruptured epidermis conspicuous; teliospores broadly clavate-oblong, 18–26 by 35–61 μ, rounded or truncate above, narrowed below, slightly constricted at septum; wall chestnut-brown, paler below, about 1–1.5 μ thick, much thicker above, 7–12 μ, smooth; pedicel short, tinted.

ON CYPERACEAE:

Cyperus atropurpureus Liebm., Mexico (state).

Cyperus Buckleyi Britton, Michoacan.

Cyperus Buchii Britton, Kansas.

Cyperus cayennensis (Lam.) Britton, Cuba; Porto Rico.

Cyperus cylindricus (Ell.) Britton (*C. Torreyi* Britton), Alabama, Texas.

Cyperus filiculmis Vahl, Connecticut, Delaware, Indiana, Kansas, Massachusetts, Nebraska, New York, Oklahoma, Texas, West Virginia, Wisconsin.

Cyperus flavicomus L., Mexico (state).

Cyperus globosus Aubl. (*C. echinatus* Wood), Alabama.

Cyperus Grayi Torrey, New York.

Cyperus hermaphroditus (Jacq.) Standley, Guatemala.

Cyperus Houghtonii Torrey, Wisconsin.

Cyperus lancastriensis Porter, Delaware.

[4] See Mycologia **10**: 129. 1918.

Cyperus mutisii (H.B.K.) Griseb., Jamaica.

Cyperus ovularis (Michx.) Torrey, Alabama, Delaware, South Carolina.

Cyperus refractus Engelm., Delaware.

Cyperus retrofractus (L.) Torrey, Alabama.

Cyperus Schweinitzii Torrey, Illinois, Iowa, Indiana, Nebraska, Oklahoma, Wisconsin.

Cyperus spectabilis Scheb., Mexico (state), Morelos.

Cyperus strigosus L., Indiana, Missouri, New York.

Cyperus sp., North Carolina.

Kyllinga brevifolia Rottb., Porto Rico.

Kyllinga pumila Michx., Grenada; Porto Rico; Martinique; Vera Cruz.

Kyllinga odorata Vahl, Guatemala.

Type locality: Decorah, Iowa, on *Cyperus Schweinitzii.*

Distribution: Massachusetts, Wisconsin and Nebraska south through Mexico, Central America and the West Indies.

Exsiccati: Barth. N. Am. Ured. *542, 837, 838, 1436;* Ellis & Ev. Fungi Columb. *1850, 2145;* Ravenel, Fungi Am. *278, 498;* Sydow, Ured. *1016, 1017, 1177.*

Puccinia Cyperi has long been confused with *P. canaliculata* as explained in the note under that species. It is most certainly entitled to recognition. The list of hosts includes three species of *Kyllinga,* a comparatively small genus rather closely related to *Cyperus.*

6. **Puccinia liberta** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly culmicolous, scattered, usually numerous, oval or oblong, 0.3–1.5 mm. long, sometimes longer by becoming confluent, tardily dehiscent by longitudinal slits, somewhat bullate, slightly pulverulent after dehiscence; urediniospores broadly ellipsoid or obovoid, sometimes more or less laterally compressed, 13–21 by 18–27 μ; the wall golden- or cinnamon-brown, 1.5–2 μ thick, moderately and finely echinulate; the pores 2, equatorial.

III. Telia rare, only few seen, resembling uredinia in shape and size, darker in color, tardily dehiscent by longitudinal slits, compact; teliospores clavate-oblong or fusiform, 14–18 by 40–50 μ, rounded or acuminate above, usually narrowed below; the wall golden- or cinnamon-brown, often paler at apex, 1–1.5 μ thick, thicker above, 4–7 μ, smooth; pedicel short, tinted.

ON CYPERACEAE:

Eleocharis cellulosa Torrey, Porto Rico.
Eleocharis flaccida (Spr.) Urb., Porto Rico.
Eleocharis geniculatus (L.) R. Br., Cuba; Guatemala; Porto Rico.
Eleocharis montana (H.B.K.) R. & S., California.
Eleocharis mutata (L.) R. & S., Porto Rico.
Eleocharis sp., Nicaragua.

Type collected at Grenada, dept. Grenada, Nicaragua, on *Eleocharis* sp., Feb. 11, 1903, *C. F. Baker 2385*.

Distribution: The West Indies and Central America and in southern California.

The species here described differs from *Puccinia Eleocharidis* very markedly in urediniospore characters. The urediniospores are smaller, somewhat thicker-walled and possess 2 equatorial pores as compared with 3–5, usually 4, equatorial pores in *P. Eleocharidis*. The distribution is tropical or sub-tropical whereas *P. Eleocharidis* is chiefly a temperate region species. Judging from the size of the urediniospores and the arrangement of the pores *Puccinia liberta* appears to be the correlated form of *Uromyces Eleocharidis*. The type specimen is a part of a collection distributed by Baker as "Plants of Central America," and although somewhat fragmentary bears both uredinal and telial stages. There is a more ample specimen of the type collection at the N. Y. Botanical Garden.

7. **Uredo incomposita** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly culmicolous, scattered or sometimes in more or less evident groups, oval or oblong, 0.4–1.5 mm. or more long, tardily dehiscent by longitudinal slits, somewhat bullate; urediniospores broadly ellipsoid or obovoid, often somewhat angular, 18–26 by 27–37 μ; the wall golden- or cinnamon-brown, moderately echinulate, 1.5–2 μ thick; the pores 2, equatorial.

III. Telia not known.

ON CYPERACEAE:

Eleocharis geniculatus (L.) R. Br., Porto Rico.
Eleocharis interstincta (Vahl) R. & S., Porto Rico.
Eleocharis sp., Guatemala.

Type collected at Mayaguez, Porto Rico, on *Eleocharis interstincta,* May 20, 1916, *Whetzel & Olive 35*.

Distribution: Known only from Porto Rico and Guatemala.

No teliospores could be found on the specimens here cited as the foundation of a new species but the urediniospore structure is so characteristic that no other disposition seems satisfactory. The pore arrangement is like that of the preceding species but the spores are very much larger and although often somewhat angular are not laterally compressed. The host of the type specimen was determined by Dr. Britton. The collection was cited as *Puccinia Eleocharidis* by Arthur in the "Uredinales of Porto Rico based on collections by H. H. Whetzel and E. W. Olive."[5]

8. PUCCINIA ELEOCHARIDIS Arth. Bull. Iowa Agr. Coll. Dept. Bot. **1884**: 156. 1884

Aecidium compositarum Eupatorii DeToni: in Sacc. Syll. Fung. **7**: 798. 1888.

Dicaeoma Eleocharidis Kuntze, Rev. Gen. **3**[2]: 468. 1898.

O. Pycnia amphigenous, few in small orbicular groups, punctiform, honey-yellow becoming reddish-brown, rather inconspicuous, globoid, 100–170 μ in diameter; ostiolar filaments 35–60 μ long.

I. Aecia hypophyllous, in crowded groups or in orbicular groups about the pycnia on discolored spots that are usually conspicuous, cupulate, low, 0.2–0.3 mm. in diameter; peridium delicate, the margin deeply lacerate and revolute; peridial cells rhomboidal, 24–34 μ long, the outer wall 4–6 μ thick, striate, the inner wall 2–3 μ, verrucose; aeciospores globoid, 16–21 by 18–24 μ; the wall colorless, about 1 μ thick, finely verrucose.

ON CARDUACEAE:

Eupatorium maculatum L., Indiana, Iowa, Nebraska, New York.

Eupatorium perfoliatum L., Delaware, Illinois, Iowa, Indiana, Kansas, Maine, Michigan, Nebraska, New York, Pennsylvania, Wisconsin; Nova Scotia, Ontario.

Eupatorium purpureum L., Alabama, Indiana, Iowa, Michi-

[5] See Mycologia **9**: 76. 1917.

gan, Nebraska, New Jersey, New York, Pennsylvania, Wisconsin, Manitoba, Quebec.

Eupatorium rotundifolium L., Delaware, Mississippi.

Eupatorium serotinum Michx., Louisiana.

Eupatorium verbenaefolium Michx., Alabama.

II. Uredinia chiefly culmicolous, scattered, oblong, 0.3–1 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate; urediniospores broadly ellipsoid or obovoid, 17–24 by 26–40 μ; the wall yellowish or light cinnamon-brown, about 1.5 μ thick, rather sparsely and finely echinulate; the pores equatorial, usually 4, in occasional spores 3 or 5.

III. Telia chiefly culmicolous, scattered, oblong, 0.5–1.5 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate, blackish-brown; teliospores clavate-oblong, 13–19 by 32–65 μ, slightly or not constricted at septum, truncate, rounded, or obtuse above, somewhat narrowed at the base; the wall light chestnut-brown, paler below, smooth; about 1 μ thick, much thicker at apex, 3–7 μ; pedicel short, tinted.

ON CYPERACEAE:

Eleocharis capitata (L.) R. Br. (*Scirpus capitatus* L.), Cuba; Porto Rico.

Eleocharis intermedia (Muhl.) Schult., Iowa, New York, Pennsylvania.

Eleocharis obtusa (Willd.) Schult., Indiana, Oklahoma.

Eleocharis ovata (Roth) R. & S., New York, West Virginia.

Eleocharis palustris (L.) R. & S. (*E. glaucescens* Willd., *E. palustris glaucescens* A. Gray), Indiana, Iowa, Kansas, Michigan, Nebraska, Wisconsin; Ontario, Quebec.

Eleocharis tenuis (Willd.) Schult., Maine, Nebraska, New York.

Eleocharis sp., Texas, Virginia; Manitoba.

Type locality: Spirit Lake, Iowa, on *Eleocharis intermedia*.

Distribution: Maine and Quebec to Manitoba, south to the Gulf of Mexico, and in Cuba and Porto Rico, with aecia known only from the eastern United States and adjacent parts of Canada.

Exsiccati: Barth, Fungi Columb. *2355, 2759, 4144, 4662;* Barth, N. Am. Ured. *338, 840, 938, 1043, 1238;* Ellis, N. Am. Fungi *1419;* Ellis & Ev., Fungi Columb. *1458, 1802, 2147;* Griff., W.

Am. Fungi *330;* Shear, N. Y. Fungi *127;* Sydow, Ured. *2023, 2414, 2516.*

Puccinia Eleocharidis is the common 2-celled form on *Eleocharis.* It is the only species on this host which has been cultured. For record of first cultures see Journal of Mycology **12**: 23. 1906. It is interesting that the aecial distribution appears to be limited to a portion of the area covered by the uredinial and telial stages. This situation is of course entirely possible but on the other hand further collecting may alter the situation. The aecia on *Eupatorium* are often not conspicuous and may have been overlooked in the southern range of the species.

9. UROMYCES ELEOCHARIDIS Arthur, Bull. Torrey Club 33: 514. 1906

Nigredo Eleocharidis Arth. N. Am. Flora **7**: 232. 1912.

O and I. Pycnia and aecia unknown.

II. Uredinia amphigenous, scattered, oblong, 0.3–1.5 mm. long, tardily dehiscent by one or more longitudinal slits, dark cinnamon-brown; urediniospores ellipsoid to broadly ellipsoid, 15–19 by 19–29 μ; wall golden-yellow, thin, 1–1.5 μ, sparsely and finely echinulate, the pores 2, approximately equatorial.

III. Telia amphigenous, thickly scattered, oblong, 0.5–2 mm. or more long, tardily dehiscent by longitudinal slits, chocolate-brown; teliospores angularly obovoid, truncate or rounded above, narrowed below, 16–22 by 27–45 μ; wall light chestnut-brown, rather thin, 1–1.5 μ, thicker above, 7–10 μ, smooth; pedicel tinted, about once to once and a half length of spore.

ON CYPERACEAE:

Type locality: Aberdeen, South Dakota, on *Eleocharis palustris.*

Distribution: Northern Mississippi and Missouri basins.

Exsiccati: D. Griff., W. Am. Fungi *60, 60a;* Barth, Fungi Columb. *2293, 3291;* Sydow, Ured. *2102, 2252;* Brenckle, Fungi Dak. *50.*

EXCLUDED NAMES

Puccinia Romagnoliana Maire & Sacc. Ann. Myc. **1**: 220. 1903.

According to the Sydow Monograph this species is near *Puccinia Cyperi.* It is even suggested that it may be only the Euro-

pean form of our species. The teliospores differ materially, particularly in thickness of walls. The walls are 2–2.5 μ thick whereas all of our species on *Cyperus* have notably thin walls, none of them having walls more than 1.5 μ thick and for the most part they are 1 μ or less. The urediniospores have pores often above the equator, an arrangement not found in any of our species.

Puccinia conclusa Thüm. in Contr. Flor. Lusit. in Jour. d. sc. math. phys. e nat. Lisboa **24**: 10. 1878. From Coimbra, Portugal.

No specimen has been available; uredinia are not described.

Puccinia subcoronata P. Henn. Hedw. **34**: 94. 1895. From Goyaz, Brazil.

Apparently differs from our species in coronate condition of teliospores. Our specimen bearing this label does not appear to be authentic.

Uredo philippinensis Sydow, Ann. Myc. **4**: 32. 1906.

Has much smaller urediniospores than any of our species.

Uredo eleocharidicola Speg. Anal. Mus. Nac. Buenos Aires **6**: 237. 1899.

Resembles *Puccinia liberta* but is not identical.

DEPARTMENT OF BOTANY,
THE PENNSYLVANIA STATE COLLEGE.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—VII

TYÔZABURÔ TANAKA

DIDYMELLA MORI K. Hara sp. nov. in Dainippon Sanshi Kwaiho (Journ. Sericultural Association of Japan), **26**^{304}: 388, 1 text cut. May, 1917. (Japanese.)

Spots inconspicuous; perithecia scattered, punctiform, black, covered by the epidermis which is raised and finally pierced, globoid or depressed globoid, 200–250 μ high, 250–300 μ in diam.; perithecial wall thick, fungoid-parenchymatous, black, cells not definitely distinguished; asci cylindric or long clavate, rounded above, attenuate to short sterigmata below, 70–80 $\times$ 5–8 μ, octosporous, paraphysate; ascospores obliquely monostichous, fusoid, ellipsoid or sub-ovoid, slightly narrowed at both ends, uniseptate at the middle, more or less constricted, 2–3-nucleate in the young stage, homogenous at maturity, colorless, 12–15 $\times$ 5–6 μ; paraphyses filiform, longer than asci, 1 μ across.

Illustrations: One text cut with four figures showing spots, perithecium, asci, and ascospores.

On twigs of *Morus alba.*

Type locality: Mino (Gifu-ken Prefecture) Kawakami-mura, Oct., 1915, K. Hara.

MYCOSPHAERELLA COLACASIAE K. Hara sp. nov. in Byôchû-gai Zasshi (Journ. Plant Protection), Tôkyô. **5**^{5}: 355–356. May, 1917. (Japanese.)

Perithecia scattered, punctiform, immersed, later erumpent, globoid or depressed globoid, 60–120 μ diam., black; perithecial wall fungoid-parenchymatous, dark-brown, cells 5–13 μ across; ostiola terminal, verrucaeform or papilliform, often not prominent, simply perforated, openings comparatively large, 25–30 μ across; asci cylindric or clavate, inconspicuously pointed above or more generally rounded, attenuate below, pedicellate, 45–70 $\times$ 8.5–10 μ, octosporous; ascospores biseriate, fusoid, more or less excentrically uniseptate, constricted, upper cell broader and

shorter, pointed, lower cell sometimes attenuate, mostly rounded, 2-nucleate in each cell, $13–17 \times 4–5\ \mu$, hyaline, colorless.

On leaves of *Colocasia antiquorum.*

Type locality: Not given. Probably Main Island (Honshû), Japan.

Spots solitary or confluent, at first round, testaceous brown, 1.5 mm. across, finally increasing to 6–30 mm., concentrically zoned and more or less sunken from the surface level, with dark brown margin and broad surrounding area of the same color; perithecia appear on the upper surface of the spots. When the diseased spots reach full maturity they can be seen from the lower surface of the leaf and appear light brownish with dark green margin.

The disease is frequently observed when the host plants are cultivated in damp soil and the first symptoms show during the hottest season. The disease greatly decreases the crop as the tubers cannot grow to the usual size.

For protection against this disease Bordeaux mixture should be used twice or three times in early summer, and if the diseased leaves can be found they should be carefully collected and buried underground with lime. Also avoid cultivation on low, damp soil.

VALSA MALI Miyabe et Yamada ex M. Miura in Nôji Shiken Seiseki (Agricultural Experiment Station Bulletin) Aomori-ken, Japan, No. 15: 117–141. *pls. 1–5,* T. 4, ix, Nov., 1915. (Japanese.)

Hyphae septate, hyaline or very pale olivaceous, intercellular, $2–4\ \mu$ across; stromata cortical, punctiform or wart-like, of various sizes (1–3 mm. diam. in cultures), no definite border to the host substratum, black, hyphae slate-black to black; pycnidia deeply immersed at the center of a stroma, flask-shaped, opening with a slender canal-like neck, $80–200\ \mu$ diam., circumscribed by black walls; pycnospores expelled as thread-like buff tendrils which at maturity are readily disseminated by water; cylindrical or allantoid, obtuse at both ends, $7–10 \times 1–1.5\ \mu$, homogeneous inside, hyaline; perithecia circinate surrounding the pycnidial cavity, flask-shaped, long-necked, with black walls, of various sizes, $100–250\ \mu$ diam.; asci numerous, clavate, often pedicellate, $20–30 \times 5–8\ \mu$, hyaline, octosporus, aparaphysate; ascospores cylindrical, slightly curved, continuous, nearly as large as pycnidia, hyaline, agranulate.

On apple, causing a somewhat destructive blight disease, called "Furanbyô" in Japanese. The disease first appears on the surface of branches as brownish spots with irregular or nearly oblong circumference, slightly elevated from healthy portion, then gradually drying out, inconsiderably sunken, more or less darkened, and cracking on the outer surface, finally disclosing the pustules which are scattered over the diseased surface. No secretion of liquid was observed, which is usual in case of fire-blight (Hiyakebyô) caused by *Bacillus amylovorus* also known in northern Japan.

Type locality: Not given. Distribution: Northern part of Honshû and Hokkaidô.

The name, *Valsa Mali,* first appeared in a list of important fruit diseases of North Island compiled by Sapporo Agricultural College, which was exhibited at the Fifth Industrial Exposition held at Osaka during 1903–04 ("Sapporo Nôgakkô Hen, Hokkaidô Jûyô Kwaju Byôgai" n. d., printed before April 1, 1903), later described by Y. Takahashi and H. Okamoto in Hokkaidô Nôji Shikenjo Ihô (Circular of the Hokkaidô Agr. Exp. Sta.) No. 5: 39–41, fig. 18, published March, 1908. A more detailed account of the fungus was given by Dr. A. Ideta in his Nippon Shokubutsu Byôrigaku (Handbook of the Plant Diseases in Japan) ed. 4, pt. 1 (1909), pp. 295–297, where the original drawing of Prof. G. Yamada is first printed and the dimensions of ascopores are given as $8 \times 1.5\,\mu$. Cultural tests were recently reported by Dr. T. Hemmi in Trans. Sapporo Nat. Hist. Soc., 6^2: 146–152 (July, 1916), and in Journ. Tôhoku Imp. Univ., Coll. of Agric., 7^4: 277–287 (Aug., 1916), where the activity of the growth is stated to be remarkably accelerated by an addition of 0.1–0.2 per cent. pyrotannic acid or 0.8 per cent. citric acid to the culture medium.

DIAPORTHE MALI Miura sp. nov. in Nôji Shiken Seiseki (Agr. Exp. Sta., Bull.) Aomori-ken, Japan. No. 15: 77–116, *pls. 2, 3, 5.* T. 4, ix, Nov., 1915. (Japanese.)

Pomiicolous, caulicolous, often foliicolous; mature spots on fruits 2–8 mm. diam., size not increasing further under natural conditions, round, solitary or irregularly coalescent, more or less

sunken, usually deeper in color than the healthy part, changing the underlying tissue to brown or dark-brown, tissue becoming spongy, imparting slightly bitter taste; hyphae intercellular, septate, 2–5 μ diam., readily producing chlamydospores and cylindrospores in culture; chlamydospores (formed in culture) catenulate, cinereous or greenish, thick-walled, conspicuously constricted at the junction, numerously granulate, 10–14 × 5–8 μ; cylindrospores (formed in culture from fruit spot) straight or curved, tapering toward the apex, pale pinkish-brown in mass, colorless or indistinctly greenish when observed alone, 2–7-septate, occasionally constricted at septum, 38–70 × 3–3.5 μ, those obtained from leaves in culture measuring 32–80 × 3–4 μ; pycnidia, formed as brownish black spots on the surface of entirely decayed fruit, numerous, irregular or often growing in concentric zones, afterwards covered by white or pale olivaceous-white cottony hyphae, semi-spherical, 70–220 × 70–130 μ, at full maturity exuding from the central opening, a pinkish-brown semi-liquid substance composed of two kinds of pycnospores, characteristic of the genus *Phomopsis;* conidiospores 15–18 × 2–3 μ; Phoma-spore ellipsoidal, pointed rather distinctly at both ends, contiunous, hyaline, guttulate at both ends, 7–9 × 3–4 μ; Septoria-spore filiform, slightly curved either near the apex or at the middle, continuous, hyaline, 24–32 × 1–3 μ; stromata formed in culture and on decayed twigs placed on culture media, irregular, black outside, white inside, 3–7 mm. diam., producing flat, central Phomosis pycnidia of about 1–1.5 mm. diam., and a certain number of surrounding Diaporthe perithecia with protruding ostiola visible to the naked eye; perithecia (observed on twigs above mentioned) spheroidal or oblate-spheroidal, 300–450 μ diam., with intensely black outer wall and light-brown inner wall; ostiola rather long, conspicuously hairy near the end, with projecting hyphae; asci fusoid, obtuse above, inconspicuously pedicellate below, 45–52 × 5–10 μ, octosporous, aparaphysate; ascospores biseriate, fusoid, both ends obtuse, one-septate, constricted, 2-nucleate in each cell, hyaline, 11–13 × 3.5–4.5 μ.

Leaf-spots occur as pale discolored areas of 1–2 cm. diam., usually producing leaf-curl and final defoliation during the summer, showing under microscope mycelial development through the tissue. Young shoots as well as bearing twigs also show irregular brownish infection at the point about six inches from the end, gradually drying and cracking the surface, finally causing death of the tip of the shoot.

On fruit, leaf and twig of apple.

Locality: Northern Japan (very common).

Illustration: Two collotype plates showing infections of twigs and fruits of apple, one lithographic plate giving detailed structure of the fungus in various stages.

Note: The fruit spot of apple (*Heikwa no Hantenbyô* in Japanese) here described is very widely distributed throughout the territory, most frequently occurring on Jonathan apple, the spotted fruit of which is almost considered as characteristic of the variety. Though closely resembling *Phoma Pomi* Pass. in the cylindrospore formation, the *Phomopsis* stage is entirely different from that, indicating a common identity with *Phomopsis Mali* Rob. which is reported as occurring only on twigs and not on fruits. The discovery of the ascogenous form in culture enabled the investigator to prove these observed forms stages of *Diaporthe*. "Diaporteose" is proposed as the new English name for this disease.

PHRAGMIDIUM RUBI-SIEBOLDII Kawagoe sp. nov. in Kagoshima Kôtô Nôrin Gakkô Gakujutsu Hôkoku (Bull., Kagoshima Imp. Coll. Agr. and Forest.), Kagoshima, no. 1; 201–203, 1 pl. T. 5, iii, Mar., 1916. (Japanese.)

III. Telia hypophyllous, elongated, orange yellow, quite conspicuous macroscopically as silky protrusions of veins through laciniately ruptured epidermis, discoloration of the upper surface being brownish, the margin of which is rather indefinite; hyphae bundles projecting from cortical as well as bast portion of substrata attain to 2,200 μ in whole length when measured with teliospore bundles; teliospores elongate-lanceolate with conspicuously long pedicels, mostly 5-celled, gradually narrowed and sharply pointed at the apex, 136–221 $\times$ 15.6 μ, the terminal cell occupying nearly one half of total length, slightly constricted at the septum, membrane smooth, equally thick, hyaline, 2 μ across, contents granular, mixed with oil globules, orange yellow; pedicels very long, average 2,000 μ in length, membrane thicker than that of spore, measuring 3 μ across, smooth and hyaline, contents also hyaline.

On leaves of *Rubus Sieboldii*.

Type locality: Toso, Nakagôriu-mura, Kagoshima-gun, Kagoshima-ken. (K. Toyohira, May, 1911.)

Illustration: One lithographic plate with a photograph of affected leaf. Teliospores and a magnified cross section of telia are given.

The fungus, discovered only in the place above mentioned, is of doubtful importance so long as the connections with other forms remain obsolete. The fungus occurs on the plant about the beginning of May and lasts until the end of June.

POLYPORUS PUBERTATIS Yasuda sp. nov. in Shokubutsugaku Zasshi (Botan. Magaz.) Tôkyô, 30^{351}: 66. Mar., 1916 (Japanese); l. c. 31^{362}: 54. Feb., 1917 (nom. nud.).

Pilei firmly suberose, sessile, dimidiate, margin semi-circular, cross-section triangular, thick, 7.5–8 × 3–4 × 2–3 cm., light; surface even, minutely velvety with soft fuzzy hairs, azonate, subfuscous; context sub-fuscous, thick; tubes long, about 0.5–1 cm., thick-walled, pinkish; mouths small, rotund; spores numerous, ellipsoid, smooth, 5 × 3 μ.

On wood bark.

Type locality: Miyagi-mura Kashiwagura, Seta-gun, Kôdzukenokuni (Gunma-ken prefecture), collected by Jûgorô Tsunoda.

Japanese name: Hônen-take.

Notes: In the latter article this fungus is placed under Sect. 4. *Fusci,* c. "Hymenium ohne Zystiden; Sporen gefärbt."

NEOTTIOSPORA THEAE Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special report, Agr. Exp. Station) Taiwan (Formosa), No. 11: 113, *pl. 4, figs. 30–31.* T. 4, ii, Feb., 1915. (Japanese.)

Spots epiphyllous, irregular, cinereous to brown, sparingly dotted with black, minute fruiting bodies, margin definite, elevated, purplish-black; pycnidia subepidermal, black, depressed globose to spheroid, 84–93 × 108–135 μ, erumpent with ostiola; pycnospores cylindrical, both ends rounded or obtuse, 12–14 × 3 μ, unicellular, hyaline, ciliate at one end; setae filamentous, 9–11 μ long.

On leaves of *Thea sinensis.* Occurring rarely on mature leaves in Formosa and seems to cause no serious damage.

Type locality: Shinchikuchô Nanshô, May 3, 1910. Y. Fujikuro.

Illustrations: Two black and white lithographic figures.

PESTALOZZIA GOSSYPII Hori sp. nov. ex S. Thuruda, in Byôchû-gai Zasshi (Journ. Plant Protection) 4^3: 27–28. T. 6, iii, Mar., 1917. (Japanese.)

Spot ochraceous-brown, about 16 mm. diam. with irregularly zoned fuligineous margin; acervuli punctate at the middle part of the spot, first covered by epidermis, then erumpent, black, 212–255 μ broad; conidiophores hyaline, $2–4 \times 0.6–0.9\,\mu$; conidia clavate, thickened at the apex, gradually narrowed toward the base, 5-celled, terminal and basal cells hyaline, 3 inner cells fulvous, the middle cell most strongly darkened ($18–27 \times 4–8\,\mu$); setae 2–3, slightly swollen at the apex, hyaline, $6–16 \times 1.6\,\mu$.

On leaves of *Gossypium herbaceum*.

Type locality: Shidzuoka-ken (prefecture) Ogasa-gun Hikimura, Dec. 10, 1916, S. Tsuruda.

Japanese name of the disease: Sômen no Hanmonbyô (Leaf-blotch of cotton).

The disease caused a little damage on the upland cotton in the Shidzuoka prefecture during the wet harvest season of 1916 but has never been reported from any other cotton-growing sections of Japan or Chôsen (Korea). It is very easily distinguished from ordinary "Hantenbyô" (Leaf-spot disease, caused by *Cercospora gossypina* Cke.) by its reddish-buffy-brown spots which, in the latter species, present a grayish-brown portion less conspicuously dotted in the center with acervuli.

The dimensions of the conidia, which are omitted in the original publication, were obtained by communication with the original author, Mr. Tsuruda, who, to our greatest regret, died a few days before the reply containing this information reached the writer of this review.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NOTES AND BRIEF ARTICLES

Professor John A. Stevenson has recently been called from his work in Porto Rico and is now a pathological inspector for the Federal Horticultural Board in Washington.

Dr. M. W. Gardner resigned the position of assistant pathologist in the Bureau of Plant Industry to take up the investigation of vegetable diseases at the Purdue University Experiment Station, Lafayette, Indiana, beginning February 1.

Mr. Edw. C. Johnson, dean of the Division of Extension of the Kansas State Agricultural College, has resigned to accept the position of dean of the College of Agriculture and director of the Experiment Station, Washington State College, Pullman, Washington.

Mr. J. A. McClintock has resigned his position as extension specialist in cotton, truck, and forage crop diseases in Georgia, to which he was appointed under a cooperative agreement between the United States Department of Agriculture and the Georgia State Experiment Station, with headquarters at Experiment, Georgia.

An important paper by Otto Reinking on Philippine Plant Diseases appeared in the March number of *Phytopathology*.

Mr. O. F. Gleason has recently sent in specimens of *Pleurotus ostreatus* collected early in March of this year. He states that he found no mushrooms growing in February.

A paper on the sporadic appearance of non-edible mushrooms in cultures of ordinary cultivated species was contributed by

Michael Levine to the February number of the *Torrey Bulletin*. *Panaeolus venenosus, P. campanulatus, P. retirugis, Clitocybe dealbata, Melanoleuca melanoleuca*, and *Peziza domiciliana* were discussed at some length and figured on three plates.

In the *Journal of Agricultural Research* for September 2, 1918, Hedgcock, Bethel and Hunt describe a new rust, *Cronartium occidentale*. The rust attacks the piñon pine, its alternate stage occurring on species of *Ribes* and *Grossularia*. While similar to the white pine blister rust which has caused so much damage in the East, it differs in several particulars. The rust does not seem to affect old trees to any great extent but is rather destructive to young ones.

Brown canker of roses caused by a new species of fungus, *Diaporthe umbrina*, is described by Anna E. Jenkins in the number of the *Journal of Agricultural Research* for December 16, 1918. The disease can be produced by inoculation with either the pycnospores or with the ascospores of the host. Sanitation and spraying are recommended as control measures. The disease has been noted in the District of Columbia, Virginia, West Virginia, Georgia and Connecticut.

In the January number of *Phytopathology* M. Shapovalov discusses Some Potential Parasites of the Potato Tuber. Three species, *Penicillium oxalicum, Aspergillus niger* and *Clonostachys rosea*, are found under favorable conditions to cause considerable damage to these tubers. From the discussion it is concluded that there are many dormant enemies of garden crops which deserve much more attention than they have been given in the past.

Harter, Weimer and Adams publish the results of their investigations on Sweet Potato Storage Rots in the *Journal of Agricultural Research* for November 11, 1918. Seventeen different species of fungi were found to be responsible. Of these the chief offenders were: *Rhizopus nigricans, Sphaeronema fimbriatum, Diplodia*

tubericola, Diaporthe batatis, Plenodomus destruens, Sclerotium bataticola and *Monilochaetes infuscans.* Other fungi which cause losses under favorable conditions are *Mucor racemosus, Botrytis cinerea, Gibberella sanbinetii, Fusarium culmorum, Fusarium acuminatum, Trichoderma Koningi* and species of *Alternaria, Epicoccum* and *Penicillium.*

The Laboratory of Plant Pathology formerly located at the Royal Botanical Gardens in Kew, England, has recently been transferred to the Rothamsted Experiment Station at Harpenden, where a large new Institute of Research in Phytopathology is being created. Professor W. B. Brierly, the director of the department of plant pathology, will greatly appreciate the cooperation of American plant pathologists in his efforts to assemble a pathological library in the institution.

Mr. Ivan M. Johnston has recently sent to the Garden herbarium a large and valuable collection of woody and fleshy fungi, collected in the mountains about Claremont, California. The collection is accompanied by valuable field notes and sketches. Several species that have been known very imperfectly are represented by a number of good specimens in this collection. Of the 104 numbers sent by Mr. Johnston, the following might be noted: *Ceriomyces flaviporus, Rostkovites granulatus, Prunulus purus, Pyropolyporus Abramsianus, Spongiporus leucospongia, Inonotus dryophilus, Fomes Arctostaphyli, Panellus stypticus, Ganoderma polychromum,* and *Funalia stuppea.*

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MYCOLOGIA

VOL. XI JULY, 1919 No. 4

ROSTRONITSCHKIA, A NEW GENUS OF PYRENOMYCETES

HARRY MORTON FITZPATRICK

(WITH PLATE 11)

An interesting Pyrenomycete parasitic on the leaves of *Gesneria albiflora* Kuntze was collected on the Island of Porto Rico in the winter of 1915 by a party of botanists representing the New York Botanical Garden. Material of this collection was studied later by Rehm, who stated in a letter to F. J. Seaver that he regarded the fungus as an undescribed species. He proposed for it the name *Nitschkia nervincola* Rehm, and inclosed in his letter a detailed Latin diagnosis. This diagnosis, dated June, 1915, is attached to the packet of material of this collection in the herbarium of the New York Botanical Garden, but apparently has not been published.

The fungus had been collected previously in 1913 and in 1914 in Porto Rico by F. L. Stevens. Specimens of some of his collections, sent to the New York Botanical Garden, were examined by Seaver and found to be identical with the material studied by Rehm. Subsequently ten different collections were deposited by Stevens in the herbarium of the University of Illinois, and in a paper[1] on Porto Rican fungi he lists them under the name *Nitschkia nervincola*. He does not describe the species, and the writer has found no other mention of the fungus in literature.

In the winter of 1916, H. H. Whetzel and E. W. Olive made extensive collections of fungi in Porto Rico, and obtained abun-

[1] Stevens, F. L. Porto Rican Fungi, Old and New. Illinois Acad. Sci. Trans. 10: 185. 1917.

[MYCOLOGIA for May (11: 101–161 was issued June 7, 1919.]

dant material of this species in excellent condition for study. Doctor Seaver identified the fungus, and suggested the advisability of studying it critically to determine whether it might not be referred more properly to some other genus. Professor Whetzel generously placed the material at the writer's disposal, and a preliminary examination revealed that the fungus differs in several important respects from other described species of *Nitschkia*. The following summer the examination of all the specimens of this species in the Herbarium of the New York Botanical Garden disclosed the fact that years before Ellis had received a specimen of the fungus collected by Mrs. E. M. Swainson in Jamaica. This specimen contains only material of the imperfect stage, and Ellis labeled it *Botrytis seriata* Ell. & Ev. The date of collection is not given, and the host is not named. The leaves are, however, indistinguishable from those of *Gesneria albiflora* and were probably taken from this host. *Botrytis seriata* was apparently never described by Ellis, and a search of literature has failed to reveal a citation of this name. The fungus is not a species of Botrytis in our present conception of the limits of this genus.

The genus *Nitschkia* Otth is included in the Sphaeriaceae-Allantosporae of Saccardo, and is a member of the Cucurbitariaceae in Lindau's arrangement of the Sphaeriales in Engler und Prantl's "Die naturlichen Pflanzenfamilien." As characterized by Lindau the Cucurbitariaceae possess globose perithecia seated on a more or less well-developed stroma. In the genus *Nitschkia* the perithecia are cespitose to scattered, and rupture a covering membrane, or are more rarely superficial. The perithecial wall is black, membranaceous to subcoriaceous, and collapses on drying, becoming cupulate. The ostiolum is inconspicuous. The asci are clavate, 8-spored, and accompanied by thread-like paraphyses. The spores are allantoid, one-celled, and hyaline. The species are typically saprophytic. Ellis in his "North American Pyrenomycetes" includes in the genus *Nitschkia* only those species in which the perithecia are cespitose, and places in the genus *Coelosphaeria* Saccardo the species with scattered perithecia. Saccardo also has adopted this conception of generic limits.

The parasite under consideration on *Gesneria albiflora* lacks certain characters common to species of *Nitschkia* and *Coelo-*

sphaeria, and possesses others not described for any species in either of these genera. The perithecium is firm, coriaceous to carbonaceous, does not collapse, and is provided with a prominent, long, stout, sulcate beak which resembles strikingly that in certain species of *Eutypa.* The ascus contains eight, distinctly yellowish, allantoid spores. The species has the perithecial characters of a *Eutypa* rather than those of a *Nitschkia.* The stroma, however, is not effuse as in *Eutypa,* and the perithecia are seated on the stroma rather than immersed in it. Moreover the fungus possesses a conidial stage unlike any which the writer has found described either in *Eutypa* or *Nitschkia.* Professor F. L. Stevens, although citing his own material of this species tentatively under the name *Nitschkia nervincola,* has stated in a letter to the writer that he sees no reason at all for so classifying the fungus.

Material was recently submitted by the writer to Doctor C. L. Shear with the request that he examine it, and state whether in his opinion this fungus could be regarded properly as a species either of *Eutypa* or *Nitschkia.* He writes that he prefers not to place the species in either of these genera. Assuming that a genus to which it could be referred has not been described recently, he would regard it as the representative of an undescribed genus. Although there are several recently described genera characterized by allantoid spores, in none of these is the perithecium similar to that of the fungus on *Gesneria.* The writer feels justified, therefore, in regarding this species as representative of an undescribed genus. Since the genus falls properly in the Cucurbitariaceae near *Nitschkia,* and on account of the presence of a perithecium with a long, sulcate beak the following name is proposed.

Rostronitschkia gen. nov.

Stromata black, formed within the host, later erumpent, bearing first conidiophores, and later perithecia. Conidiophores united to form stout, capitate coremia or stalked sporodochia (Plate 11, Figs. 3, 4), bearing hyaline to yellowish, ovate, unicellular conidia. Perithecia developed beneath the conidial layer, pushing upward, at maturity seated in a single row on the stroma; not cespitose as in *Nitschkia.* Perithecial wall black, coriaceous to carbonaceous, prominently wrinkled and roughened, not collapsing, provided with a long, stout, 4-sulcate beak, resembling that in some species

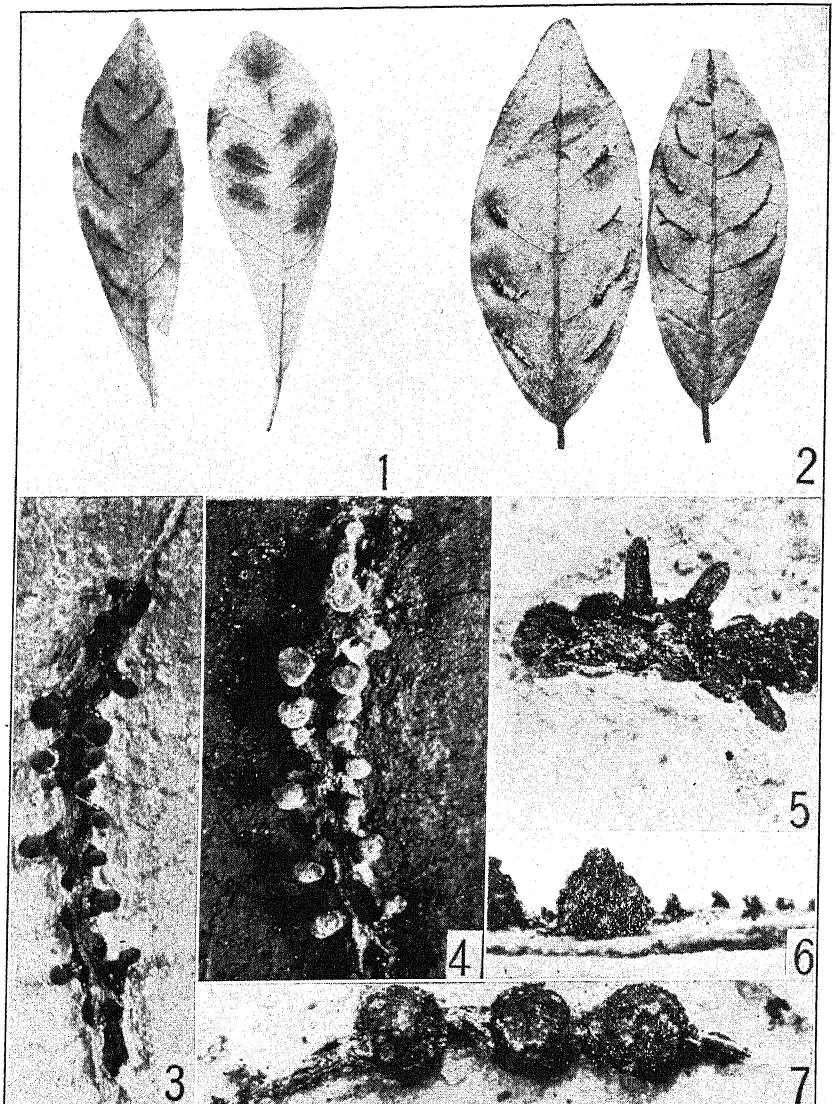
of *Eutypa* (Plate 11, Fig. 5). Ascus clavate, 8-spored, aparaphysate. Ascospores allantoid, yellowish, unicellular.

Rostronitschkia nervincola sp. nov.

Nitschkia nervincola Rehm, in litt.

Stromata formed in the secondary veins of the leaf, more rarely in the midrib (Plate 11, Fig. 2), erumpent on the lower side as very narrow, linear, black cushions, 0.3–0.5 × 2–10 mm.; the upper surface of the leaf immediately opposite these stromata showing definite diseased spots (Plate 11, Fig. 1) which, though sometimes narrow and confined to the upper surface of the vein, commonly spread over a wider area; these spots in early stages often distinctly rose-colored, later turning brown; the ruptured stromata developing first conidiophores and later perithecia; conidiophores pushing outward in compact masses forming numerous, stout, capitate coremia or stalked sporodochia, 275–600 μ in diam. at apex × 400 μ in height, scattered irregularly along the stroma or in one or two rather definite rows (Plate 11, Fig. 3); coremium dusty brown, the apical portion frequently whitish and pruinose with conidia (Plate 11, Fig. 4), composed of yellowish-brown, frequently septate, branching conidiophores, which at the outer ends are abundantly and characteristically marked with scars indicating the points of detachment of conidia; the first conidium borne terminally, the conidiophore then sending out immediately below it a short lateral branch which bears a second conidium; the tip of the conidiophore as the result of the continuation of this process assuming a peculiar crooked appearance; conidia hyaline to yellowish, ovate, somewhat pointed at one end, unicellular, 5–6 × 1.5 μ; perithecia developed beneath the conidial fructifications, and pushing outward so that the latter fall away or remain attached to the outer surface of the perithecial wall; perithecium globose, 1 mm. in diam. seated on the stroma, and provided with a long, stout, 4-sulcate beak attaining a length of slightly more than 1 mm., and terminated by the ostiolum; perithecia borne in a single row along the stroma, adjacent perithecia frequently confluent; perithecial wall dull-black, coriaceous, becoming carbonaceous on drying, not collapsing, prominently wrinkled and roughened; ascus clavate, 8-spored, 18–26 × 5–6 μ; ascospores allantoid, unicellular, at first hyaline, later becoming distinctly yellowish, 6.7–8.4 × 1.7–2 μ, sub-biseriate to irregularly crowded; paraphyses absent.

Parasitic in the leaves of *Gesneria albiflora* in Porto Rico and Jamaica. Not known to the writer from other localities nor on other hosts.



EUTYPANITSCHKIA NERVINCOLA (REHM) FITZPATRICK

Specimens examined:

PORTO RICO, *Maricao;* H. H. Whetzel and E. W. Olive. Exploration of Porto Rico. No. 699, *type* (in N. Y. Bot. Gard. Herb.; in Pl. Path. Herb. Cornell Univ. No. 9656; and in Fitzpatrick Herb. No. 1023); N. L. Britton, J. F. Cowell, Stewardson Brown, The New York Botanical Garden, Exploration of Porto Rico No. 4557 (in N. Y. Bot. Gard. Herb.), material of this collection described by Rehm in a letter to Seaver as *Nitschkia nervincola* Rehm; F. L. Stevens, Univ. Illinois Herb. Nos. 207, 735, 3498, 3670, 6718 (in N. Y. Bot. Gard. Herb.); *Mayagüez,* F. L. Stevens, Univ. Illinois Herb. No. 6725 (in N. Y. Bot. Gard. Herb.).

JAMAICA, *Richmond, Trinity Ville;* Mrs. E. M. Swainson (in N. Y. Bot. Gard. Herb. Ellis Collection). Specimen labeled *Botrytis seriata* Ell. & Ev. by Ellis.

EXPLANATION OF PLATE 11

Fig. 1. Upper surface of leaves of *Gesneria albiflora* parasitized by *Rostronitschkia nervincola.* The diseased spots occur immediately opposite the stromata, which are always hypophyllous. Natural size.

Fig. 2. Lower surface of leaves of the same host showing the stromata of the fungus in the secondary veins and midrib. Natural size.

Fig. 3. A stroma of *Rostronitschkia* bearing coremia of the imperfect stage. × 11.

Fig. 4. The same stroma photographed under different light conditions to emphasize the whitish pruinosity at the apices of the coremia. × 11.

Fig. 5. Mature perithecia of *Rostronitschkia* confluent in a single row on the stroma. Note the prominent, sulcate beaks. × 11.

Fig. 6. A younger perithecium in which the beak has not yet developed. Several coremia of the imperfect stage appear at the right. × 11.

Fig. 7. Three mature perithecia, the beaks of which have been broken away. × 11.

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NOTES ON SOME POLEMONIACEOUS RUSTS[1]

C. R. Orton

Of the many problems encountered in taxonomic work with any group of plants that of nomenclature is sure to require a considerable amount of time and often more patience than the worker possesses. There are always some names in question whose identity is not certain because of discrepancies, either with regard to the labelling of type specimens or in connection with the published descriptions. The situation becomes more acute for the taxonomist working with parasitic organisms. Here the chance of error is practically doubled for both parasite and host are concerned.

A good example of such a situation has been encountered in the study of several rusts on polemoniaceous hosts. Several students of the rusts have been puzzled with this particular tangle and some valuable information has come to light. Holway[2] published some notes bearing on these species several years ago but since then few, if any, descriptive notes have appeared. During the preparation of the manuscript on the genus *Allodus* the writer[3] was compelled to reinvestigate this entire group of rusts with the result that some interesting facts have been disclosed which are thought to be of sufficient importance to record for the benefit of subsequent workers.

One of the earlier difficulties in connection with this group of rusts was due to the inaccessibility and consequent uncertainty regarding type specimens. During the summer of 1918, through the efforts of Dr. J. C. Arthur, Prof. H. S. Jackson, and other members of the botanical staff of the Purdue Agricultural Ex-

[1] Joint contribution from the Department of Botany, Indiana Agricultural Experiment Station, and the Department of Botany, The Pennsylvania State College, No. 16.

[2] Holway, E. W. D. Notes on Uredineae, IV. Jour. Myc. 11: 268. 1905.

[3] Orton, C. R. North American Species of Allodus. Mem. N. Y. Bot. Garden 6: 198–200. 1916.

periment Station, I was enabled to complete the examination of the types or portions of types of nearly every species here discussed and some of the uncertainties existing heretofore appear to be cleared up as thoroughly as it is possible to do so until cultures are made to verify their life histories.

Most of the uncertainties regarding the phlox rusts have centered around the well known species *Puccinia plumbaria* Peck, which is a rather common rust throughout the Rocky Mountain region on *Microsteris* and *Phlox*. Inasmuch as most of the confusion has been due to uncertainties and errors in host determinations considerable time has been given to the identification of the hosts, particularly the hosts of the type specimens. These have been submitted to various experts on this family such as Dr. P. A. Rydberg, Mr. P. C. Standley, and others to whom I extend thanks for their interest and the time they have taken from their many duties to make these studies.

For convenience in discussion, I have divided these rusts into three groups as follows: (1) *Allodus Giliae,* (2) *Allodus Douglasii* and (3) *Other outstanding species.*

1. ALLODUS GILIAE (Peck) Orton

Aecidium Giliae Peck, Bot. Gaz. 4: 230. 1879

This species was founded on a collection by M. E. Jones from Alta, Wasatch Mts., Utah, in August at an elevation of 8,000 ft. on leaves of *Gilia Nuttallii.* A portion of the type collection in the Peck herbarium was very kindly loaned by Dr. H. D. House and was found to bear aecia only. The host is undoubtedly named correctly and has been verified by Mr. Standley.

Another collection in the Peck herbarium was made by Jones at Alta, 10,000 ft. elevation, on the same host and bears only telia which appear in every way identical with *Puccinia plumbaria.*

Puccinia plumbaria Peck, Bot. Gaz. 6: 228. 1881

Peck described this conspicuous rust on the living leaves and stems of *Collomia gracilis* and *Phlox longifolia* from material collected by M. E. Jones in Utah and his description says in "June and August." The most striking gross character of this

rust is the plumbeous appearance of the telia which are found on the leaves and stems. When the telia rupture, powdery, chocolate colored spores appear which upon microscopic examination are found to be finely but conspicuously verrucose. This surface marking of the teliospores is most pronounced upon the host genera *Microsteris* (*Collomia*) and *Phlox* and less evident upon the host genera *Leptodactylon* and *Linanthus,* although on the latter genera the verrucose markings are easily seen when the spores are examined dry under the higher objectives of the microscope. Teliospores from the type material measure 19–25 by 31–40 μ with the apex 5–7 μ thick and the pedicel fragile, colorless and fugaceous.

Both hosts mentioned by Peck in the original description are correct, but there is a discrepancy in the dates. The type material on *Microsteris* (*Collomia*) in the Peck collection bears the date May 5, 1880, and the "co-type" on *Phlox* bears the date June 6, 1880. There is no collection by Jones on *Collomia* in the Peck herbarium bearing the August date. We must therefore conclude that the dates in the original description should have been May and June.

Puccinia Wilcoxiana Thüm. Myc. Univ. *2032.* 1881

The original description of this rust is in Latin printed upon the exsiccatum label. The type was stated to be on some undetermined species of *Gilia* collected at Boise City, Idaho Territory, April, 1881, by J. E. Wilcox.

A small portion of the type material has been examined and appears identical with *Puccinia plumbaria* as that fungus appears on *Microsteris.* While the host material is rather scanty it has been possible to determine the host as *Microsteris humilis* Greene an annual plant clearly distinct from *Gilia Nuttallii* A. Gray which is perennial.

The question of priority of name arises with respect to this and the preceding species. In the New York Botanical Garden Herbarium there is a letter from Dr. W. G. Farlow to Mr. J. B. Ellis with regard to this matter. Dr. Farlow is of the opinion that Century XXI of Thümen's Mycotheca Universalis was not issued until after June and that Peck's name has precedence.

Another bit of substantiating evidence is the date of collection, April, 1881. It would hardly be possible for specimens collected in Idaho on this date to be sent to Europe and issued in an exsiccatum before June, the time of publication of *Puccinia plumbaria*.

Puccinia plumbaria phlogina Ellis. N. Am. Fungi *1044*. 1883

Ellis issued a collection under this name in the above exsiccatum but failed to publish a description for it. The name is therefore a hyponym. The host was said to be *Phlox Nuttallii* and the specimen was collected by Harkness in California in 1884. There is in the herbarium at Albany a specimen which is undoubtedly a portion of this collection. The host is *Phlox longifolia* Nutt. and the rust is *Allodus Giliae*. Owing to the advanced stage of the rust when collected the plumbeous character is less evident than usual, a fact which no doubt led Ellis to assign a varietal name to this specimen.

Aecidium Wilcoxianum Thüm. Myc. Univ. *2226*. 1884

Under this name a collection made at Boise City, Idaho, April, 1881, by Dr. J. Wilcox, was issued by Thümen without description. It was said to be upon *Phlox Douglasii* but the specimens in the Arthur Herbarium are too fragmentary for host determination. The rust appears to be identical with *Aecidium Giliae* Peck. What appears to be a portion of the same collection was issued under the same name in Roumeguere Fungi selecti exsiccati *5213*. Being issued without description in both cases the name is to be cited as a hyponym.

Aecidium Cerastii Winter; Winter & Demetrio, Hedwigia **24**: 179. 1885

This species was described in an article by Winter and Demetrio entitled "Beitrage zur Pilzflora von Missouri," which appeared in "Heft V" (September and October). In the Jour. Myc. **1**: 126. 1885, No. 10 (October), an article by Dr. Winter appeared under the title "Fungi Novi Missourienses" in which he describes *Aecidium Cerastii* Winter nov. spec. with the identical Latin description used in Hedwigia. What evidence there

is seems to indicate that the Hedwigia article appeared first and is therefore to be given preference in citation. The type was described as on living leaves of *Cerastium nutans* Raf. May, 1885. No. 559. A collection which is a portion of the type bears a label with this further information "near Joh. Hof's residence, Perry Co., Mo.," collected by C. H. Demetrio. A careful examination of the type which is in the possession of Rev. Demetrio shows that the host is probably *Phlox divaricata* and the rust certainly *Allodus Giliae* comparing exactly with similar material on *P. divaricata* from Iowa.

Aecidium Phlogis Peck; Arth. Bull. Iowa Agr. Coll. **1884**: 167. 1885

This name was used by Arthur in a "Preliminary List of Iowa Uredineae" to designate a collection on *Phlox divaricata* var. *Laphamii* Willd. collected at Decorah, Iowa, June 8, 1882, by E. W. D. Holway. On careful examination of this specimen a few telia were found and the rust is *Allodus Giliae* without doubt. The collection on *Phlox pilosa,* Ames, cited under the same name has not been seen and its identity is unknown. No description accompanies the name and it is therefore a hyponym.

Puccinia patagonica Speg. Bol. Acad. Nac. Ci. Argent. **11**: 29. 1887

Spegazzini described this species from collections made at Rio S. Cruz and Rio Gallego, January and August, 1882, on a common *Collomia.* The host species however was not named.

The type collection of this rust has not been seen but the description fits *Allodus Giliae* very closely. Dr. W. G. Farlow sent the writer a specimen from the Farlow collection labelled "Sydow Uredineen 35a. *Puccinia plumbaria* Peck in foliis calcibusque *Collomiae* sp. Ad Mont. ignion. Colloqui. 1. 1896." This was collected by Neger in Chili. The specimen bears telia only which are apparently identical with those of *Allodus Giliae.* This indicates that *A. Giliae* occurs in South America and substantiates the view that Spegazzini's species is probably identical with *A. Giliae* and should be entered in the synonymy of this species.

The observation of Spegazzini that *P. patagonica* differs wholly from *Puccinia Giliae* Farl. is quite correct. We interpret this reference to *P. Giliae* Farl. as an error for *P. Giliae* Ellis & Hark. which is discussed later in this paper.

Puccinia fragilis Tracy & Gall. Jour. Myc. **4**: 20. 1888

The type collection was described as on *Arenaria pungens* collected at Reno, Nevada, June 19, 1887. Holway[4] has called attention to the host plant which he says is *Phlox*. In the Arthur Herbarium there are three packets purporting to be portions of the type collection. One was taken from the collection of S. M. Tracy, July 5, 1900, and bears the data above and the collectors names, Tracy & Evans. Another specimen marked "type" was received from a collection in the Iowa Agr. College in October, 1898, and bears the same inscription except that Evans's name does not appear on the packet as co-collector. The third packet came from the Holway Herbarium and bears the number *4591*, otherwise the inscription is like that on the first mentioned packet. Examination of the material shows only telia. The host is probably *Phlox longifolia* Nutt. and the rust is certainly *Allodus Giliae*.

Aecidium Phlogis Ellis & Ev. Bull. Torr. Club. **24**: 284. 1897

This species was described from a collection on *Phlox longifolia,* made near Lewistown, Idaho, April, 1896, by A. A. Heller (No. 2992). Ellis and Everhart published the following note with the description: "This is not improbably the *Aecidium* of *Puccinia plumbaria* Peck which is found on the same host." What is apparently a portion of the type collection was issued by Ellis & Ev. in N. Am. Fungi *3582* and is most certainly the aecial stage of *Allodus Giliae* although I have seen no specimens of this collection bearing telia on the same plant.

Puccinia Purpusii P. Henn. Hedwigia **37**: 270. 1898

Hennings described this species from a collection made by Mr. C. A. Purpus in California. The original description included both aecia and telia and purports to have been collected at Potter

[4] Holway, E. W. D. (loc. cit.).

Valley, Mendocino Co., California, on *Arabis spec.* Holway (1) was apparently the first to call attention to the fact that the rust was *Puccinia plumbaria* and the host some species of *Phlox* or a closely related genus.

The type collection has been examined through the kindness of Dr. P. Sydow, who loaned all the material with the original label to Dr. Arthur for study. The label reads as follows: ("Uredo?) No. 3. on Cruciferae? spec. Potter Valley, Mendocino Co., Calif. A. P. 94." This is in the handwriting of Mr. Purpus, who has recently confirmed it from a photograph of the label sent him by the writer. After the figure "3" the name *Purpusii* is written, but by a different hand, very probably Dr. Hennings. This is undoubted type material and consists of several fragmentary stems and leaves of some plant closely resembling *Microsteris gracilis.* Most of the leaves bear the aecial stage, but one leaf is well covered with telia of the plumbeous sort. The rust is without doubt *Allodus Giliae.*

Puccinia giliicola P. Henn. Hedwigia **37**: *270.* 1898; Rab.-Paz. Fungi Eur. *4221.* 1901

Much confusion has existed concerning the exact identity of this species. Hennings published it under the name *P. Giliae* Ellis & Hark. The type being collected on *Gilia californica* at Snow Mt., Coast Range, California, about 7,000 ft. Aug.–Sept., 1894 (A. Purpus). What is undoubtedly the same rust and host and probably a portion of the same collection has been issued under Rabenhorst-Pazschke, Fungi Europaei et extraeuropaei *4221,* and Sydow, Uredineen *1212* but the locality in both of these exsiccati numbers reads, Potter Valley, Mendozo (Mendoc in Sydow Ured. *1212*) Co., Calif., instead of Snow Mountain, Coast Range. Whether there was another collection I have not been able to determine but authentic type material kindly loaned by Dr. P. Sydow with the original penciled label written on American paper reads "Pilz on *Gilia?* Spec. . . . Snow-Mt. Coast-Range—Aug.–Sept. 7500–8000 ft." This label was photographed and sent to Mr. C. A. Purpus, Vera Cruz, Mexico, who writes as follows: "The label enclosed in your letter was written by me.

The fungus was collected on a Gilia spec. growing on rocks at an alt. of 7–8000 ft. on Snow Mt., in the Coast Range of Lake County in northern California. Snow Mountain is one of the highest elevations in the Coast Range as far as I know." Prof. T. S. Brandegee writes that "Snow Mountain is a well known high mountain situated at the corner of Lake and Mendicino Counties, California." It seems probable therefore that in some way the locality for the type collection of *P. giliicola* was confused by Hennings with that of *P. Purpusii* which would account for the discrepancy in localities on the different packets. The specimens in all the packets considered here are identical.

The host of *P. giliicola* is an acerose leaved plant, small and apparently well adapted for dry climates. The rust is in the advanced telial stage only and the sori are not noticeably plumbeous. The spores average a little narrower than those of *Allodus Giliae* being 15–21 $\times$ 32–45 μ and are practically smooth. In this respect it compares favorably with collections on *Leptodactylon Nuttallii, Microsteria gracilis* and *Linanthus ciliatus.* Many taxonomists would consider this a distinct species but I believe it to be only a depauperate form of *A. Giliae*. The "uredospores" mentioned by Hennings in the published description are apparently mesospores or single cells of broken teliospores as no urediniospores have been found after several careful examinations.

Aecidium patagonicum Speg. Anal. Mus. Nac. Buen. Aires 3^a. 1: 66. 1902

Spegazzini described this Aecidium on living leaves of *Collomia gracilis* collected near Carren-leofú, in the summer of 1900 (N. Illin.). He says this *Aecidium* appears with *Puccinia Patagonica* and it is probable that the two stages belong together. The type of *A. patagonicum* has not been seen but Spegazzini gives the measurements of aeciospores as 14–16 μ which compare closely with those of *Aecidium Giliae* Peck.

Following is a list of synonymy and host plants of

ALLODUS GILIAE (Peck) Orton, Mem. N. Y. Bot. Gard. **6**: 199. 1916

Aecidium Giliae Peck, Bot. Gaz. **4**: 230. 1879.

Puccinia plumbaria Peck, Bot. Gaz. **6**: 228. 1881.

Puccinia Wilcoxiana Thüm. Myc. Univ. *2032*. 1881.

Puccinia plumbaria phlogina Ellis, N. Am. Fungi *1044*. 1883 hyponym.

Aecidium Wilcoxianum Thüm. Myc. Univ. *2226*. 1884 hyponym.

Aecidium Cerastii Wint.; Winter & Demetrio, Hedwigia **24**: 179. 1885; Jour. Myc. **1**: 125. 1885.

Aecidium Phlogis Peck: Arth. Bull. Iowa Agr. Coll. **1884**; 167. 1885 hyponym.

Puccinia patagonica Speg. Bul. Acad. Nac. Ci. Argent. **11**: 29. 1887.

Puccinia fragilis Tracy & Gall. Jour. Myc. **4**: 20. 1888.

Aecidium Phlogis Ellis & Ev. Bull. Torr. Club **24**: 284. 1897.

Puccinia Purpusii P. Henn. Hedwigia **37**: 270. 1898.

Puccinia giliicola P. Henn. Hedwigia **37**: 270. 1898; Rab.-Paz. Fungi Eur. *4221*. 1901.

Dicaeoma fragile Kuntze, Rev. Gen. **33**: 468. 1898.

Dicaeoma plumbarium Kuntze, Rev. Gen. **33**: 470. 1898.

Aecidium patagonicum Speg. Anal. Mus. Nac. Buen. Aires. 3ª. **1**: 66. 1902.

Allodus plumbaria Arth. Result. Sci. Congr. Bot. Vienne 345. 1906.

ON POLEMONIACEAE

Leptodactylon californica H. & A. (*Gilia californica* Benth.) California.

Leptodactylon Nuttallii (A. Gray) Rydb. (*Gilia Nuttallii* A. Gray.) Colorado, Nevada, Utah.

Linanthus ciliatus (Benth.) Greene. (*Gilia ciliata* Benth.) California.

Microsteris gracilis (Dougl.) Greene. (*Collomia gracilis* Dougl. Gilia gracilis Hook.) California, Montana, Oregon, Utah, Washington.

Microsteris humilis Greene, Idaho, Utah.

Microsteris micrantha (Kellogg) Greene. (*Collomia micrantha* Kellogg.) Colorado, Montana, Utah.

Phlox divaricata L. Illinois, Iowa, Missouri.

Phlox longifolia Nutt. California, Colorado, Idaho, Nevada, Utah.

Phlox multiflora A. Nels. Colorado.

Phlox speciosa Pursh. Oregon.

Phlox Stansburgii (Torr.) Heller. Nevada.

2. ALLODUS DOUGLASII (Ellis & Ev.) Orton

Puccinia Douglasii Ellis & Ev. Proc. Acad. Phil. 1893: 152. 1893

The species was described on *Phlox Douglasii* collected at Detroit, Utah, May 26, 1891, by Marcus E. Jones. The rust differs quite markedly from *Puccinia plumbaria* in that the telia arise from a diffused mycelium usually in linear series on each side of the midrib and the sori are very early naked and prominently pulvinate. The spores are much thickened above with smooth walls and concolorous persistent pedicels. The aecial stage differs in no pronounced way from the aecial stage of *P. plumbaria* and it is extremely difficult to decide where certain aecial collections belong. *Puccinia Douglasii* however seems to constantly inhabit acerose or narrow leaved species of *Phlox* and the aecia do not change the form of the leaf so pronouncedly as do the aecia of *P. plumbaria.* A portion of the type material was submitted to Mr. Standley, who identifies the host as *Phlox diffusa.* *Puccinia Douglasii* therefore is not at present known to inhabit *Phlox Douglasii.*

Puccinia Richardsonii Sydow, Monog. Ured. 1: 317. 1902

The Sydows described this species from material collected at Helena, Montana, May, 1896, on *Phlox Richardsonii* by F. D. Kelsey, and issued by Ellis and Everhart in N. Am. Fungi *2991* under the name *Puccinia Douglasii.* The host is apparently *Phlox diapensioides* Rydb. and the rust differs in no essential character from *P. Douglasii* on *Phlox diffusa* except that the spores average a little longer.

Following is a list of the synonymy and hosts of

ALLODUS DOUGLASII (Ellis & Ev.) Orton, Mem. N. Y. Bot. Gard. 6: 198. 1916

Puccinia Douglasii Ellis & Ev. Proc. Acad. Phila. **1893**: 152. 1893.

Dicaeoma Douglasii Kuntze, Rev. Gen. **33**: 468. 1898.

Puccinia Richardsonii Sydow. Monog. Ured. **1**: 317. 1902.

ON POLEMONIACEAE

Phlox alyssifolia Greene. Montana.
Phlox amoena Sims. (*P. procumbens* A. Gray.) Pennsylvania.
Phlox depressa (A. Nels.) Rydb. Montana.
Phlox diapensioides Rydb. Montana.
Phlox diffusa Benth. Oregon, Utah, Washington.
Phlox glabrata (E. Nels.) A. Brand. Wyoming.
Phlox Hoodii Richards. Montana, Utah.
Phlox nana Nutt. New Mexico.
Phlox rigida Benth. Utah.
Phlox scleranthifolia Rydb. Nebraska.
Phlox subulata L. New Jersey.

3. OTHER OUTSTANDING SPECIES

Aecidium Polemonii Peck, Bot. Gaz. 4: 230. 1879

This *Aecidium* which has been shown by Arthur[5] to be the aecial stage of *Uromyces acuminatus* was first described on *Polemonium reptans* from Iowa. It is now known that the same rust goes to species of *Collomia* and *Phlox* as well as to *Gilia* in all probability. This *Aecidium* is to be distinguished from the *Aecidium* of *Allodus Giliae* by its larger aeciospores which are $15–24 \times 18–27\,\mu$ as contrasted with $13–19 \times 14–22\,\mu$, the size of aeciospores of *A. Giliae*. The walls of the peridial cells also appear to be regularly thicker in *A. Giliae* than in *Nigredo Polemonii*.

Puccinia Giliae Hark. Bull. Calif. Acad. Sci. **1**: 34. 1884

Harkness[6] described this rust which is usually ascribed to

[5] Arthur, J. C. Cultures of Uredineae in 1910. MYCOLOGIA 4: 29. 1912.

[6] Harkness. New Species of California Fungi. Bull. Calif. Acad. Sci. **1**: 29–47. 1884.

Ellis & Harkness[7] whose combined paper appeared immediately preceding that of Harkness. The type was collected on leaves and subtending bracts of *Gilia ciliata*. Mt. Diablo, May. *2996*.

There appears to be no specimen in the Ellis collection and it seems probable that Harkness did not send Ellis any of this material. Prof. W. C. Blasdale has kindly visited the Herbarium of the California Academy and found one specimen which he takes to be the type. He says in his letter to Prof. H. S. Jackson (June 8, 1916): "The specimen consists of a single head of *Gilia ciliata* evidently collected after the plant had dried up." The packet bore the following data: *Puccinia Giliae* Hk. Gilia, dead stems, Antioch, June 17, 1882, *2996*. In commenting upon the discrepancy between this data and the published account Prof. Blasdale states further "although the published description gives Mt. Diablo as the type locality I think this specimen represents the type collection as Antioch is near the base of Mt. Diablo and Harkness was decidedly inaccurate in his data relating to his collections. The specimen bears a half dozen sori on the floral bracts."

My examination of a portion of this material sent by Prof. Blasdale shows smooth spores much thickened above ($7–13\mu$) and measuring $18–28 \times 40–60\mu$ with pedicel up to 100μ, rather persistent. It has been impossible to make a careful search for urediniospores with the limited material at hand, but in the one mount made a few appeared which seemed to correspond in every way with the rust which appears on several species of *Gilia* in California and adjacent states which when collected early bears abundant uredinia. The presence of urediniospores and the smooth teliospores conspicuously thickened at the apex makes this rust distinct from any others known on these hosts. It is known at present only from the Rocky Mountain region and the Pacific Coast.

Puccinia arabicola Ellis & Ev. Jour. Myc. 6: 119. 1891.

The type of this rust collected by Dr. Macoun and described as forming aecia and telia on *Arabis* sp., Ottawa, Canada, is in

[7] Ellis, J. B., and Harkness. New Californian Fungi. Bull. Calif. Acad. Sci. 1: 26–29. 1884.

the Ellis Herbarium at the New York Botanical Garden. It consists of a single, long-petioled orbicular leaf with six groups of aecia and about ten telia scattered over the under leaf surface. Holway reported that this rust varied in no way from the eastern specimens of *Puccinia plumbaria* Peck on *Phlox divaricata* and that the host was probably some species of *Phlox*. At the time of publishing my *Allodus* paper I had not examined carefully the aeciospores and peridial cells of the species. I have now critically studied it and believe it to be distinct from *Puccinia plumbaria* and I think the host must certainly be some cruciferous plant probably *Cardamine Douglasii* (Lam.) Britton as suggested by Dr. N. L. Britton, who has carefully examined and compared the type collection with phanerogamic collections. The aeciospores are considerably larger than those of *Puccinia plumbaria*.

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THE MYCOLOGICAL WORK OF MOSES ASHLEY CURTIS

C. L. Shear and Neil E. Stevens

That America's first eminent mycologists were both clergymen, and both, though northern men by birth, became residents of North Carolina early in their careers is perhaps to be regarded as more than a coincidence (7, pp. 54). A century ago there were few professional botanists in this country and botanical work was carried on as an avocation by men of other callings, largely by physicians (13), and clergymen, while the state of North Carolina is unsurpassed in this country in the variety of its plant forms.

In the particulars cited, the life of Moses Ashley Curtis bears a strong resemblance to that of his great predecessor Lewis David de Schweinitz. In other aspects, however, they were strikingly different. Schweinitz was educated largely in Europe, began his botanical work there, and returned to Europe at least twice. At the age of forty-one, when his botanical work was well under way, he left the South and made his home in Pennsylvania. Curtis, on the other hand, was educated wholly in this country, appears never to have visited Europe, and spent most of his adult life in the Carolinas. His contact with foreign and most American botanists was chiefly through correspondence. The writers have already presented the available data on the life and work of Schweinitz (18), in the belief that the interpretation of his work by present day botanists would be thus facilitated. With a similar purpose, they have collected in the present paper such facts as are available regarding Curtis' mycological work.

The most complete sketch of the life of Moses Ashley Curtis is that published by Dr. Thomas F. Wood (21) who was a personal friend of Curtis. This contains a good portrait. Briefer sketches, one by Dudley (7), one by Scribner (17), and an unsigned one in Popular Science Monthly (22), probably written

by W. J. Youmans, then editor of that journal, are based largely on Wood's paper. An appreciation of Curtis' work, and outline of his activities by Asa Gray (11), which was originally published in the Proceedings of the American Academy of Arts and Sciences, was reprinted with only a slight verbal change in the American Journal of Science and later in the scientific papers of Asa Gray. In addition to the publications mentioned and others which will be cited, the writers have obtained considerable information from other sources.

By far the most important source of information regarding Curtis, to which the writers have had access, is the correspondence of the late Prof. Edward Tuckerman, Jr., of Amherst, Mass. This correspondence, fortunately preserved almost complete, and now the property of Tuckerman's nephew, Judge E. T. Esty, of Worcester, Mass., to whom the writers are greatly indebted for permission to use the material here presented, forms an exceptionally valuable source of information regarding the botanists of that time. The correspondence between Tuckerman and Curtis began about 1839 and extended to 1867. A packet of letters written by Curtis to E. C. Howe, of New York, covering the period 1866 to 1870, was kindly loaned to the writers by Mr. Stewart H. Burnham, of Hudson Falls, N. Y. Several letters from Curtis are in the collection of the Academy of Natural Sciences of Philadelphia, for the use of which the writers are indebted to the secretary, Dr. Edward J. Nolan. In addition to those above mentioned, the writers have been furnished valuable information by Prof. Elmer A. Green, Registrar of Williams College, Curtis' son, the Rev. Charles J. Curtis, of Accokeek, Maryland, and Dr. W. G. Farlow, of Harvard University.

SKETCH OF CURTIS' LIFE

Moses Ashley Curtis was born May 11, 1808, at Stockbridge, Mass. His father was the Rev. Jared Curtis, then of Stockbridge but later, for many years chaplain of the State prison at Charlestown.[1] His mother was a daughter of Gen. Moses Ashley. He

[1] The reference to Curtis having been born in Charlestown, found in The Letters of Asa Gray (12, Vol. 2, p. 652, footnote), is evidently a mistake, due to the fact that his father was for a long time a resident of that city.

prepared for Williams College largely under the tuition of his father, who kept a school in Stockbridge.[2] Curtis' cousin, Mark Hopkins,[3] also received a part of his early training from Jared Curtis.

Curtis graduated from Williams College in 1827. Three years afterward (October, 1830, 21, p. 10) he went to Wilmington, N. C., as tutor in the family of Governor Dudley. In 1833 (21, p. 15), he returned to Charlestown, Mass., for a year and a half, where he prepared his first botanical paper and began his studies for the ministry. He married Miss Mary de Rosset of Wilmington, December 3, 1834, and was ordained in the Episcopal Church in 1835, and at once took up missionary work in western North Carolina, with headquarters at Lincolnton. From early in 1837 to May, 1839, he was engaged as a teacher in the Episcopal School at Raleigh. The summer of 1839 was spent in the mountain country largely for his health, but that he used this time to good botanical purpose is evidenced by the testimony of Asa Gray (10, p. 12), that "no living botanist is so well acquainted with the vegetation of the Southern Alleghany Mountains . . . as the Reverend M. A. Curtis." Early in 1840 (21, p. 16) he was called to mission work about Washington, N. C., and early in 1841, removed to Hillsboro. Here, with the exception of nine years (1847–1856) spent at Society Hill, South Carolina, he resided until his death in 1872.

EARLY BOTANICAL WORK

Both Gray (11) and Dudley (7) note that Curtis' attention must have been early directed to botany, and in the letter transmitting the manuscript of his "Woody Plants of North Carolina" (5) to Dr. Ebenezer Emmons, then state geologist, Curtis writes as follows (5, p. 6):

> "I will state in conclusion, what you were not before aware of, that this Report is one of the fruits of your long continued service in the field of Science. My first knowledge of the elementary forms of Botany was derived from

[2] Information in a personal letter from Rev. Charles J. Curtis.

[3] Born at Stockbridge, Mass., February 4, 1802, eldest son of Archibald Hopkins and Mary Curtis.

yourself and your distinguished Preceptor, Prof. Eaton, at the beginning of your public career. Though I was then too young to be admitted to your course of instruction, an impulse was then given which never abated, and now, forty years afterward, returns back to you with this humble offering. The contribution is, therefore, most appropriately put in your hands by

Your friend and servant,
M. A. CURTIS."

The significance of this reference is apparent when it is recalled that in 1817 Amos Eaton (8) after two years at Yale chiefly under the tuition of Silliman, returned to Williams College, from which he had graduated in 1799, and there offered courses in geology and botany. As far as the writers have been able to determine, Eaton was not a member of the faculty, but with the enthusiastic approval of the faculty gave his courses to such students as chose to take them and among these students was Emmons.

Encouraged by the success of his work at Williams, Eaton gave courses of popular lectures on botany at various places in New England and New York. Prof. A. Hopkins (brother of Mark Hopkins) gives a striking description of Eaton[4] and his methods and refers to the fact that his "young pupil Emmons" was employed to collect plants for the demonstrations which accompanied the lectures. It is highly probable that the lecture so vividly described by Hopkins was delivered in his home town of Stockbridge and that Curtis, then nine years of age, may have attended the lecture. "The course of Instruction," to which Curtis refers, may have been that given in the nearby Lenox Academy in the spring of 1819 (8, p. 361). At any rate, as his own letter testifies, Curtis received his earliest botanical inspiration from the vigorous popular lecturer who had earlier encouraged Torrey (13, p. 136), and whose "Manual of Botany" was Asa Gray's first botanical text.

[4] Durfee (8, p. 360) gives a good biographical notice of Amos Eaton, which is copied by Nason (16) and used as a basis of the sketch published in Popular Science Monthly. There is also a good life of Eaton by Harlan H. Ballard in Collections of the Berkshire Historical and Scientific Society, pp. 185–234, 1897, and a sketch of his geological work in Merrill (15).

Curtis' first botanical paper was "Enumeration of Plants Growing Spontaneously Around Wilmington, North Carolina, with Remarks on Some New and Obscure Species." In this paper, which was prepared after only two years' residence in North Carolina, the author's powers of observation and aptitude for research are, according to Gray (11, p. 472), well shown. It is probable that much of Curtis' time while in college and during the three years succeeding his graduation, about which we have no record, was spent in botanical exploration in the Berkshires.

MYCOLOGICAL WORK

While Curtis never lost his interest in flowering plants, it was in mycology that his most notable work was done and it is as a mycologist that he is chiefly known. That Curtis was early interested in cryptogams and in touch with the literature on the subject is evidenced by his first letter to Tuckerman:

RALEIGH, N. C.
Feb. 18th, 1839.

Dear Sir:—

I was much gratified this day by the rec't of your "Enumeration of some Lichenes of N. England". Accept my thanks for your favor with an assurance that I am much pleased with every attempt to elucidate the Cryptogamia of our country . . . I am the more interested in your attempt because I hope to receive some advantage from it when I come to take up that order more systematically than I have yet done. I have hitherto worked upon it very unsatisfactorily and much at random, for want of suitable help. The libraries of this State afford me no encouragement and I cannot supply myself with books. I repeat then, that I hope you will go on in your effort.

. . . .

I think you would find much scope for interesting investigation among the Algae and Hepatic Mosses. The latter have received considerable attention from Schweinitz but the former have been entirely neglected as far as I know. (I can send you a copy of Schweinitz's Hepaticae if you do not own it.)

According to Wood, Curtis was in correspondence with Torrey as early as 1833 (21, p. 15) and met Ravenel in 1835. By 1840 he was carrying on a correspondence and exchange of specimens with Darlington and others and had accumulated an herbarium.[5] His correspondence was, however, confined to America,[6] and even late as 1844 his letters are devoted chiefly to phanerogams.

In 1845 Tuckerman seems to have given definite stimulus to Curtis' interest in cryptogams by requesting his assistance in collecting lichens, to which Curtis replies enthusiastically as follows:

HILLSBOROUGH, N. C., Nov. 7, 45.

Dear Sir:

Your letter reached me today, and I give an early answer as you desire. Your request, particularly when I consider the ground & purpose of it, has certainly my "sympathy", but I cannot now say how much you may expect from my "cooperation". I have several times thought I would take up the Lichens, & once made a small collection in the Low Country of this State, but the difficulty of studying *without* books embarrassed my progress & damped my zeal pretty effectually. Consequently I have now little on hand.

I am desirous of seeing a *complete* N. A. Flora, & am therefore glad that your attention is directed to a department which, if left to Torrey or Gray, would, I suppose, get a go-by. And I am willing to do what I can to help you on in the work, but my ability will not perhaps go to the extent of your wishes & need. I am at present in a region not abundant in interesting vegetable forms. It is probably in the swamps of the low country that peculiar forms of Lichens would be found, where the soil, climate, & elevation, are so different from the N. States. The middle region of the South is not so much unlike the North, & has much more of the Northern Flora. Besides, my present habitat has the precise features of that occupied by Schweinitz, when a resident of this State. It is not likely therefore that I should procure anything here which he has not already furnished Fries with. Nevertheless, I am disposed to try, & if leisure & health permit I will endeavor to collect something this winter for you. Without practice in this line, & with hardly any knowledge of species, it is not unlikely that I shall

[5] Letter to Tuckerman dated Portsmouth, N. C., Sept. 7, 1840.
[6] Letter to Tuckerman dated Washington, N. C., Feb. 11, 1841.

overlook many things, or perhaps even mistake a diseased excrescence for a Lichen.

Only eight days later he writes Tuckerman again.

HILLSBOROUGH, N. C., Nov. 15th /45

Dear Sir:

You will hardly expect from my last letter that I should commence work in your service so promptly as this. Nevertheless, I have nearly every day since been making some accumulations. What with my wood-pile, & the trees and old rails & posts on my premises, I have already got a small box full of specimens of something. Today I have taken a walk to some small wooded heights in the vicinity, here honored with the name of mountains, where I observed much more than I could bring home, upon the Trees, Rocks, & Earth.

I am met at the outset with what may be a serious annoyance to you. As I do not know a single species with certainty, & my ignorance is a hindrance to memory, I cannot tell at any time what I may have gathered before. And thus I may possibly send you scores of specimens, & not a score of species. I am also afraid to make a comparison of specimens from different localities & different species of trees for the purpose of throwing out a redundance of duplicates, for fear that I might overlook some slight differences which in your eye would be of essential interest, I find I need some training in order to serve you efficiently. To this end, it occurs to me that after all I had better have a set from you as a guide. By some study of it, I could in a little while get some general knowledge of Genera, & learn some of the distinctions of species. This would give important practice to the eye. From your letter to me, I judge that you have sets to spare. If therefore you will let me have one, as complete as you can spare, even as a *loan,* it will facilitate my progress very much, & probably save you the trouble of examining much trash.

I observe on the rocks—of which there is no lack here any more than in the country about Boston—many peculiar & pretty forms of crustaceous Lichens which I can devise no means of obtaining. What is the process? Let me know about this; & if they can be got off you shall have some.

I wish to see your specimens also, in order to know what sort of things to make. I have thus far chipped from trees small bits & strips of bark which do not include the whole thallus, though I intend they shall always show its margin.

Specimens from you will be of service in this respect. Suppose I send you a few in a pamphlet? I could send in this way large quantities, if you will endure the postage on them. —Shall I send a box for you at once?—& risk the wintry sea between Petersburg & N. York? Or, shall I wait till Spring and send a larger collection?

It is not unlikely that this work will excite sufficient interest in the subject to induce a desire of having a collection of Lichens; & possibly of making them a study. If so, I shall desire that a specimen of whatever I send you may be returned with a name. But of this more hereafter.

Respectfully,

M. A. CURTIS.

A month later he refers to an earlier attempt to study lichens, letter dated Hillsborough, N. C., Dec. 16th/45.

Every load of wood is overhauled as it comes to my yard, & no stick goes upon my fire that is not faithfully examined. I think I must have five or six hundred or more species, & representing twenty or more genera.

. . . .

Some years ago, when I started in this direction I was met by the same difficulty, & quit in despair, sending a part of my collection to Torrey (which I presume he threw away), & neglecting most of the remainder, I started at that time with some earnestness, &, if I could have then had a little assistance from a good Lichenist & some books, I should have been by this time somewhat au fait in this department.

My zeal in reviving again somewhat, & if I receive sufficient aid & encouragement from you, I shall probably go on with some vigor.

. . . .

Whenever good specimens of Fungi have presented themselves in my search for Lichens, I have enclosed some for Fries.

. . . .

I hope you will work up the N. A. Lichens. Just give me prestige enough, & I will see that those of Carolina are looked after. Furnish the stimulus, & I shall keep going, I reckon. My hands are sore cutting off bark,—blistered and torn.

Truly yours,

M. A. CURTIS.

A letter written January 8, 1846, shows that shipping specimens by freight proved too slow for Curtis' growing impatience and contains his first reference to a serious study of fungi, to which he has already given some attention.

HILLSBOROUGH, N. C. Jan: 8th/46

Dear Sir:

You solicited my assistance in collecting Lichens with a fear, no doubt, that I might decline the service on account of being too troublesome to me. There is now some danger that the most trouble will be in the other direction. I am getting impatient to know some of these Lichens—all of them indeed—but I can be kept somewhat comfortable by learning a few at a time. There will be progress—& that is what I wish to realize. With your permission then, I will occasionally, till my box reaches you, send a few specimens by letter that you may give me the names. I will not trouble you to write letters in reply, but merely to send a sheet containing the names of the plants, if you can do it without too much labor or annoyance.

. . . .

I have taken out from the collection such Fungi as I could readily lay hands on. Some probably remain, which you can throw into the fire. But I will be obliged to you to communicate my proposal to Fries. I shall be glad to know something of this Order. How can I get a copy of Schweinitz Synopsis Fungorum?

I have several times attempted the Fungi, but with small means have made small progress. The Musci (frondosi) hurt my eyes too much, & I quit them long ago. But the Musci Hepatici I still dabble at. Can you send me any of these?

At this time (1846) it was evidently his plan to depend upon Fries for assistance in the identification of fungi.[7]

On April 27, 1846, he states that he has secured copies of Schweinitz's "Synopsis N. C. Fungi," and also the "U. S. Fungi."

There is a break of over a year in the correspondence between Tuckerman and Curtis (1846–1847). During this time Curtis began correspondence with Rev. M. J. Berkeley which effectively

[7] Letters to Tuckerman dated Hillsborough, N. C., April 13, /46, and April 27, /46.

fixed his attention on fungi. Early in 1848, he writes Tuckerman as follows:

SOCIETY HILL, S. CAR., Jan: 17th 1848

Dear Sir:

Yours of the 3d inst: reached me today, forwarded from Hillsborough, N. Car;—I removed here last April.

Since I last heard from you I have devoted my researches chiefly to Fungi—though I do not neglect the Lichens. For some time I continued to collect the latter very vigorously, but gradually became more fond of the former, until they have come to absorb pretty much all my attention.

That his study of fungi had been productive is evidenced by the publication in November, 1848, of his first mycological paper. In the introduction to this paper, Curtis gives a résumé of early mycological work in America and concludes as follows (4, p. 351):

At present I do not know that any American botanist is giving this obscure but interesting order any special attention, except H. W. Ravenal, Esq., of South Carolina, and myself.

In the present paper are enumerated two decades of Fungi not before included in any American publication, and one of new species. They are taken at random from lists of several hundred, which will be published from time to time hereafter. To acknowledge a heavy debt of obligation, and to insure to the following list an authority which I could not myself give it, I must here state that nearly all the species have passed under the eye of my very attentive and generous correspondent, Mr. Berkeley.

JOINT WORK WITH BERKELEY

The collaboration of Berkeley and Curtis to which the paragraphs just quoted are the first published reference, was not only profitable to both correspondents concerned but most advantageous to the progress of mycology, especially in America. That Curtis transmitted to Berkeley not only his own collections but fungi sent him by various American correspondents, notably, Ravenel, Michener, Peters, Sprague, Wright, Murray, Russell, Blake, Morse, and Sartwell, is evident from published references

(1). Some idea of the extent of Curtis' work is gained from the sentence with which Berkeley concludes the introductory paragraph to the first of the series of "Notices of North American Fungi," which appeared in Grevillea (1, p. 33).

> "Cyphers following the descriptive characters are those of an enormous mass of Fungi amounting to more than 6,000 numbers forwarded to me from time to time by the late Doctor Curtis."

Berkeley's letters sent to Curtis have been lost or destroyed, since according to the Curtis heirs, none are to be found among his correspondence and Dr. Farlow informs the writers that they are not with the Curtis collection of fungi at Harvard. The Berkeley correspondence which is in the British Museum contains, however, many letters from Curtis, the first of which, according to information kindly furnished by Miss Elsie M. Wakefield of the Royal Botanic Gardens, Kew, is dated April 17, 1846, and the last, March 12, 1872. With Berkeley's Herbarium at Kew are two small volumes containing the manuscript lists with notes and comments on the Carolina fungi[8] which Curtis sent to Berkeley with the specimens. A copy of this manuscript is in the library of the New York Botanical Garden. With the Curtis collections at Harvard are lists of several thousand numbers of the specimens sent to Berkeley with the corresponding numbers of the original collections. These are apparently copies which Curtis kept for his own reference.

To publish a complete bibliography of Berkeley and Curtis' work would be needless duplication of the excellent list given by Farlow and Trelease (9). It should be noted, however, that the series of papers under the title of "North American Fungi," beginning in 1872, were published by Mr. Berkeley after Curtis' death. These contained many species attributed to Berkeley and Curtis, based in part on manuscript notes furnished by Curtis with the collections. This series alone lists 1,005 species of American fungi. Curtis' contribution to this joint work was much more than that of a mere collection, as is plainly evidenced by the fact that the specimens he sent Berkeley were accompanied by

[8] Personal letter from Miss Wakefield dated Nov. 5, 1916.

manuscript lists of the specimens sent, together with notes and comments. It is therefore appropriate that even after Curtis' death, Berkeley published many of the new species under their joint authorship.

Study of the Schweinitz Collection

Perhaps the most important single piece of work undertaken jointly by Berkeley and Curtis was their study of the Schweinitz collection of fungi. Through the courtesy of Miss E. M. Wakefield in examining Curtis' letters to Berkeley now preserved at the British Museum, the writers were able to publish some account (18, p. 334–7) of the way in which this work was done. From this, it appears that Curtis spent 17 days, during the summer of 1851, in the study of the fungi in the Schweinitz Herbarium. There is a letter to Tuckerman dated "Phila. July 22nd, '51," which may very probably have been written during the time Curtis was engaged in this work. On the promise, apparently, of additional specimens for the herbarium (19, p. 555), (18, p. 335) and of "a critical review of the fungi" (18, p. 336), he was permitted to take a specimen from the collection when there were more than two of any species. Whenever the fragment which he took from the Schweinitz herbarium was large enough he divided it and sent a part to Berkeley, also in some cases a portion to Fries. Curtis was thus able to send to Berkeley nearly fifteen hundred specimens to keep, and later over three hundred which were to be returned when done with, as they could not be divided.

Of the promised "critical review" only one installment was published, this appeared in July, 1856, when as stated in the introduction "about one fourth of the species" had been reviewed. Much more of the material must have been critically examined later, however, as in Berkeley's personal copy of Schweinitz "Synopsis Fungorum in America Boreali" now in the library of the U. S. Department of Agriculture (see 18, p. 338) species are checked and sketches of spores occur throughout the book. Dr. Farlow writes in a personal letter dated Nov. 18, 1917, that in Curtis' copy of Schweinitz work, now in his possession, many of

the species are checked, evidently with the intention of indicating whether or not Curtis actually saw the specimens in the Schweinitz herbarium.

Regarding the preparation of the joint paper referred to above, the writers have found no correspondence. There are however in the files of the Philadelphia Academy of Natural Sciences several letters from Curtis which indicate that he prepared the material for the press, and corrected the proof. Portions of these letters which were probably written to Dr. Zantzinger, then secretary of the Academy and which are self explanatory, are published below.

SOCIETY HILL, S. CAR. Jan: 17th, '53.

Dear Sir:

There is now nearly ready a paper upon the Exotic Fungi of Herb. Schwein: which he never published. Mr. Berkeley thought it best to begin with these, as being material mostly new. The notice of his American species will follow in time, as we can reduce the materials. The task is more difficult than I had anticipated.

. . . .

Please inform me then, *when* you will be ready to publish this paper;—whether in quarto or octavo size;—& in regard to proofs, whether you allow us any copies, & how many.

SOCIETY HILL, S. CAR. Feb. 1st, 1853.

Dear Sir:

Your favor is received.—The paper on the Schweinitzian Fungi is not quite completed, but I hope to be able to forward it in four or five days.—In the meantime I send you the drawings by Mr. Berkeley sufficient for one Plate. It is doubtful if I shall have enough for another Plate. If not, there will be no more sent.

. . . .

I will be obliged to you for proofs of the Plate and Letter Press.—Your allowance of 20 copies to the Author is very liberal, & we will be obliged to you for them.—Please have 10 sent to me, & retain the others until I learn what disposition Mr. Berkeley will have me make of it.

With many thanks for your uniform courtesy, I remain, dear sir,

Very respectfully & truly yours,

M. A. CURTIS.

[This letter was addressed on the back to Dr. Zantzinger.]

SOCIETY HILL, S. C., Feb. 4th, 1853.

Dear Sir:

I herewith send manuscript.—The hand is a very awkward and puerile one, but printers have generally thought it very legible. So I hope there will not be much trouble about correcting proofs.

I should like to have the names, immediately attached to each Number, in other words, each species named & described, to be printed in small caps or italics. I prefer the former. I leave this however to your judgment, & so have not underscored said names.

I ought to have suggested in my last, that the figures engraved should correspond in size with the drawings sent, though I hope your artist has already thought of that.—The explanation of figures on the last page of MSS now sent will show the reason of this.

I shall be glad to hear of the safe arrival of this, and the Drawings sent on the 1st inst.

Very truly yours,

M. A. CURTIS.

SOCIETY HILL, S. C., Feb. 21st, 1853.

Dear Sir:

I have your favor of the 15th, & am glad to learn that my two envois arrived safely.

I do not like to put my inferior drawings upon the same plate with Mr. Berkeley's, & I have not enough to make another Plate. I have therefore concluded not to send any.

Please remember to send me proofs, & much oblige,

Yours very truly,

M. A. CURTIS.

SOCIETY HILL, S. C. Apr. 5th, '53

Dear Sir:

By last mail I returned proofs of the 2nd instalment of the "Exotic Fungi."—If in altering the *Plate* (a matter about which I have no knowledge) there be much trouble, the slight correction of fig: 3, a, might be left unnoticed, as it is a matter of no great importance.—The correction in the names at the bottom of the page should be attended to.

. . . .

Very respectfully,

M. A. CURTIS.

P. S. Could Dr. Leidy send me by *Letter* specimens of some of the Microscopic Fungi observed by him on animal tissues? I should like to examine them.

SOCIETY HILL, S. CAR Apr. 16th, '53.

Dear Sir,

. . . .

Can you add the following note to our Article

Since the Article on Exotic Fungi was put to press it has been ascertained that Gnadenhutte is in Ohio; & that Bishop Hueffel, while visiting the Moravian Missions on the Danish W. India Islands in 1827, collected many plants.

This note can be altered to suit your taste, if you do not like the cut of it.

. . . .

Very respectfully,

M. A. CURTIS.

The footnote mentioned in this letter is to be found at the bottom of page 293 of the paper as published in the bound volume. It also occurs in the authors' separates which are dated April, 1853, instead of March as stated in the introduction to the volume, page 4.

While engaged in studying the fungi in the Schweinitz herbarium, Curtis urged Tuckerman to undertake a study of the lichens, advice which Tuckerman considered worth acting upon as is evidenced by his published works (18, p. 341).

Letter to Tuckerman.

SOCIETY HILL, S. C. March 4th '53.

. . . .

I am engaged with Mr. Berkeley in a critical review of the Fungi of Herb. Schwein. our paper (upon the exotic species) to appear probably in next No. of Trans. Philad. Acad.

Would you not serve a good end by a similar review of the Lichens of that collection?

. . . .

FLORA OF NORTH CAROLINA

That Curtis' interest in fungi never entirely replaced his interest in other plants is evidenced by his publication, as a part of the Geological and Natural History Survey of North Carolina, of

a catalogue of the plants of his adopted state. This was published in two parts, the first (5), a popular account of the trees, and shrubs, was issued in 1860, and the other, a catalogue of all the plants of the State, in 1867. The second portion was apparently nearly ready for the press when the Civil War broke out, but from letters to Tuckerman dated February 5, 1866, and February 23, 1866, it appears that some of the material was revised after the war. An account of some of the difficulties he encountered in securing publication after the war has been presented elsewhere (19). That it was published at all under such circumstances is evidence of the author's enthusiasm and persistence. As might be expected in a list of plants prepared by Curtis, the cryptogams find a larger place than was usual at that time. As acknowledged in the preface, the Musci and Hepaticae were identified by Sullivant, the Lichens by Tuckerman, while the fungi, probably all passed through Berkeley's hands.

Upon Emmons, the state geologist, who like Curtis was a native of Massachusetts but a resident of North Carolina for several years, the Civil War seems to have produced a profound and painful impression. He writes Marcou (14, p. 15): "I cannot but look with great fear upon the results of agitation. It unfits me for work." Whether or not Curtis shared this feeling can only be surmised. In Curtis' letters to Tuckerman, there is no hint of his personal attitude or opinions regarding the war. In his letter to Governor Jonathan Worth (6, p. 3), transmitting for publication that portion of his flora which had been delayed by the Civil War, Curtis refers to the delay as due to "more important matters of national interest that were then occupying the public mind."

The shortage of food in the south during the war (20 and 21) turned Curtis' attention to an intensive study of edible fungi. His success in securing food in this way induced him to prepare an illustrated manual of edible mushrooms designed for popular use, the manuscripts and plates of which were evidently finished with the assistance of his son, Rev. Charles J. Curtis, some time during the year 1865. The enormous cost of publishing such a work, especially in the decade immediately following the Civil War prevented its publication. This manuscript is still in the possession of the family.

LATER WORK

That Curtis' botanical work after the Civil War was materially hindered by the condition of his health is apparent from his letters. As early as 1866, he writes:[9]

> "Nos. 4 and 5 would require an amount of eye-work, for a satisfactory determination, which my present health will not permit. So I must leave them for better times."

This by no means indicates that he had lost any of his enthusiasm or interest in mycology. His letters at this time to Howe are full of instructions for collecting fungi and suggestions for their study, and are sometimes illustrated by sketches of spores and asci. On Feb. 7, 1867, he writes Howe:

> "Never mind about repeating the same things. Send anything that comes to hand. Your fire-wood will furnish much material during Winter, both in Lichens and Fungi."

On April 17, 1868, after a break of about three or four months in the correspondence with Howe, he writes:

> "I am still ready, if you desire it, to aid you, so far as I can, in working up the fungi of your region of country.
>
> "Since your last package was reported, I have determined several hundred species for C. F. Austin."

In July, 1868, he speaks of a contemplated trip for his health.[10]

> "I expect to leave home shortly for the Cumberland Mts. in Tenn. I hope a few weeks' relaxation will restore me to customary. If not, I shall have to relinquish microscopy."

The trip was partly successful and on November 20, 1868, he writes him again:

> "My health is improving, & I will work away at your Fungi, so far as I can without a resort to the Microscope;— a little at a time."

[9] Letter to E. C. Howe, dated Hillsborough, N. Car: Nov. 12, 1866.

[10] Letter to Howe dated Hillsborough, N. C., July 14th, 1868.

DISTRIBUTION OF CURTIS' SPECIMENS OF FUNGI

Berkeley was of course Curtis' most constant and most valued mycological correspondent and collaborator and to him duplicates of most of his collections of fungi as well as those from Michener,[11] Ravenel and others were sent. These are preserved in the herbarium of the Royal Botanic Garden, Kew, together with Curtis' manuscript lists, with his notes and comments of the fungi he sent to Berkeley. As suggested in the letters to Tuckerman printed above, and in letters to Berkeley published earlier (18, p. 335), Curtis sent many of his own collections as well as some duplicates of the fragments he took from the Schweinitz herbarium to Fries; all these are at Upsala. Among the American correspondents to whom Curtis sent specimens in exchange, Ravenel and Michener are known to have received large numbers of fungi. His correspondence with Ravenel began early (about 1835?) and continued until Curtis' death. In 1868, he wrote as follows concerning their relations:[12]

> "P. S. I enclose a few specimens lately sent for determination from Mr. Ravenel of S. C. He has a prior claim over all others, & the examination of his specimens has interfered somewhat with that of yours."

Ravenel's herbarium is now in the British Museum, and Michener's in the Pathological and Mycological Collections of the United States Department of Agriculture (19, p. 556). In 1857 Curtis presented to the Philadelphia Academy of Natural Sciences a collection of nearly eight hundred species of fungi. These were mounted by Doctor Michener (19, p. 555).

About two years before his death, which occurred on the 10th of April, 1872, Curtis determined to dispose of his duplicate specimens of fungi. Concerning this matter he writes Howe as follows:

[11] Curtis correspondence and exchange of fungi with Michener evidently began some time before 1855. Some fragments of it have already been published by the writers (18, pp. 548–49).

[12] Letter from Curtis to Howe dated Hillsborough, N. C., May 29, 1868.

HILLSBOROUGH, N. C. March 22/70.

Dear Sir:

I do not know whether or not I have mentioned my wretched state of health for a few months past. I have suffered dreadfully during the Winter with Neuralgia in my heart. For a few days I feel much better and hope I shall be myself again ere long.

It has lately occurred to me that perhaps I might dispose of my spare Fungi to some advantage to myself, & others. I have a large stock of duplicate specimens, which I would be glad to be rid of. It will be no small trouble to put them up, but if I can be properly remunerated I will undertake the labor.

Now do you know of any individual, or of any club or society, that will give me Fifty Dollars for a collection of Fungi that will be third in America as to quantity and value? My own is first, Schweinitz (in Acad. Nat. Sc. Phil[ae].) second.

I will guarantee 1500 species. There may be 2000 or more. I will not increase my price if there be more than 1500. I will diminish the price (in proportion) if there be less.

The collection will be particularly valuable, as being composed very largely of *authenticated* species, both of European & American authors.

As I am well advanced in life & not likely to do much more active service in Mycology, I would be glad to have my stock of specimens disposed of to best advantage before I quit the stage. It will be a tedious job, requiring months of time, to put up such specimens as I have; but I desire that they shall get into proper hands, where they may be useful & of standard authority, instead of being scattered here & there, or possibly lost entirely.

Let me know about this, if you think it likely my stock will be wanted.

I have lately come upon specimens of Corynites brevis, B & C, which will be of use to you if you get hold of that plant of which you sent me a sketch. I made no record of the thing, & forget what I called it, but believe it was C. brevis. (Of all your *numbered* specimens I keep a list.) I should be very glad to get specimens of your N. York species. Do try to get some this year.

Yours truly,
M. A. CURTIS.

How many of the sets of fungi were prepared is not known, but one appears to have been purchased by Peck and another by Bessey, whose herbaria are respectively in the New York State Museum at Albany and in the herbarium of the University of Nebraska at Lincoln.

After Curtis' death his own herbarium, containing hundreds of co-types of Berkeley and Curtis species, as well as portions of Schweinitz specimens, was purchased by Dr. Farlow and is now in the Cryptogamic herbarium at Harvard. Dr. Farlow writes:[13]

> "There are [with the Curtis herbarium] lists of several thousand numbers of the things sent to Berkeley with the corresponding numbers of the original collections so that there is no difficulty in recognizing the numbers quoted by Berkeley in Grevillea."

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BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

SMUTS AND RUSTS OF UTAH. III

A. O. Garrett

USTILAGINALES

4. Thecaphora deformans Dur. & Mont.

North American Flora (7^1: 42. 1906) lists collections from Utah on *Astragalus missouriensis* Nutt. and on *Homalobus tenellus* (Pursh) Britton (*Astragalus multiflorus* A. Gray).

Professor Marcus E. Jones collected specimens on *Astragalus Thompsonae* Watson in a canyon above Tropic, Garfield Co., May 28, 1894, at an altitude of 1950 m.

9. Ustilago hypodytes (Schlecht.) Fries

In internodes of *Distichlis spicata* var. *stricta* (Torr.) Scribn.: *2272*, Aug. 24, 1914, West Fourteenth South St., Salt Lake City.

In internodes of *Elymus condensatus* Presl.: Collected by Wyatt W. Jones near Murray, Salt Lake Co., Sept., 1918.

North American Flora (7^1: 5. 1906) lists a collection in Utah on *Stipa* sp.

12. Ustilago Lorentziana Thüm.

In inflorescence of *Sitanion hystrix* (Nutt.) J. G. Smith: *2285*, June 16, 1915, near sand dunes between Garfield and Saltair, Salt Lake Co. The host was determined by Mrs. Agnes Chase. No smut has previously been reported on this host. The smut was sent to Dr. Clinton, who writes, under date of October 20, 1915, "I am not sure whether the fungus represents a new species or not. It is close to *Ustilago Lorentziana* and *U. bromivora.* I have placed it provisionally under *U. Lorentziana* (?), but am not quite satisfied with that disposition."

13. Ustilago macrospora Desmaz.

In leaves of *Elymus canadensis* L., Salt Lake City, May, 1915.

A collection from Utah on *Agropyron* sp. is recorded in N. A. Flora (7^1: 241–258. 1906).

14. USTILAGO STRIAEFORMIS (Westend.) Niessl.

A collection of this species from Utah on *Phleum pratense* L. is listed in North American Flora 7^1: 19. 1906.

UREDINALES

2. AECIDIUM TITHYMALI Arthur, Bull. Torrey Club **45**: 151. 1918

This rust was called *Aecidium Euphorbia* Pers. in the first paper on the "Smuts and Rusts of Utah." It has now been decided that the true *Aecidium Euphorbiae* does not occur in America. From field observations made at Cimarron, Colorado, the latter part of July, 1918, the writer feels confident that *A. Tithymali* is the aecial stage of *Uromyces occidentalis*. This was the only aecium found in the locality. Wherever it occurred, the Uromyces (on *Lupinus Greenei* A. Nels. ?) was very abundant. There was not one center of infection, but several, and they were several hundred yards apart. Moreover, the *Aecidium Tithymali* was for the most part too old to make good specimens, while the *Uromyces* was in prime condition.

4. PUCCINIA MONOICA (Peck) Arth. I

Aecidium monoicum Peck.

Another collection was made in the summer of 1915 of the *Aecidium* on *Sophia* sp. (since determined as *S. leptostylis* Rydb.), referred to in previous papers of this series (Mycologia **2**: 271. 1910, and Mycologia **6**: 241. 1914) as No. 4 (*Aecidium monoicum*). The collection in the summer of 1915 was made in Big Cottonwood Canyon not far from the place where the original collection was made.

On *Schoenocrambe linifolia* (Nutt.) Greene (*Sisymbrium linifolium* Nutt.). Collected by Professor Marcus E. Jones, May 25, 1908, at White River, Uinta Co., alt. 1800 m. (No. 7787 Jones.)

7. PUCCINIA ALTERNANS Arth. III

On *Bromus* sp.: *2292a*, July 12, 1915, near Silver Lake, Big Cottonwood Canyon, alt. about 2615 m. This was weathered

material, with an abundance of fresh aecia on the surrounding *Thalictrum* plants. The collections of aecia listed under the name of *Aecidium* sp. (No. 7 of this series of papers) belong to *Puccinia alternans*.

Dr. Arthur now considers *Puccinia alternans* to be a race of *Puccinia Agropyri* Ellis & Ev. (Mycologia 7: 73–75. 1915).

9. GYMNOSPORANGIUM NELSONI. I

On *Peraphyllum ramosissimum* Nutt. Collected by Professor Marcus E. Jones (No. 6029), at Asays, Garfield Co., Sept. 11, 1894, alt. 2250 m.

15. MELAMPSORELLA ELATINA (Albert & Schw.) Arth.

Peridermium elatinum Schw. & Kze.

On *Abies* sp. Collected by Professor Marcus E. Jones at Strawberry Valley, August, 1883.

This rust forms large witches' brooms on the alpine fir (*Abies lasiocarpa*).

17. PHRAGMIDIUM IVESIAE Sydow, Ann. Myc. 1: 329. 1903

Ph. affine Syd.

On *Potentilla glomerata* A. Nelson: *2345*: II, iii, July 24, 1917, Emigration Canyon, Salt Lake Co. Host determined by Dr. Rydberg. The host of the collection reported from the Hot Pots (No. *727*) given in the original paper as *Potentilla glomerata* has been determined by Dr. Rydberg[1] as *Potentilla dichroa* Rydb.

28. PUCCINIA BALSAMORRHIZAE Peck

Mr. Wyatt W. Jones, botanist of the American Smelter and Refining Company's Experiment Station, made a collection of rust in II and iii in Salt Lake Co., May 10, 1915, on *Balsamorrhiza hirsuta* Nutt., which is tentatively referred to this species.

34. PUCCINIA CINEREA Arthur. III

On *Puccinellia airoides* (Nutt.) Wats. & Coulter. Collected by Ellsworth Bethel, November 15, 1917, at Marysvale, Piute Co.

[1] Bull. Torrey Club, 37: 490. 1910.

38. PUCCINIA COMANDRAE Peck. III

On *Comandra pallida* DC. Collected by E. M. Hall, July 14, 1918, in Zion Canyon, Washington Co.

45. PUCCINIA DOUGLASII Ellis & Ev.

On *Phlox* sp. Collected by Professor Marcus E. Jones (Jones 1695) at Gold Mountain, August 22, 1901.

48. PUCCINIA CYNOMARATHRI Holway, North American Uredineae 1: 94. 1913

This was listed in the first paper on the "Smuts and Rusts of Utah" as *Puccinia Ellisii* De Toni, but Professor Holway has described it as a distinct species in the publication cited above.

57. PUCCINIA HARKNESSII Vize

On *Stephanomeria* sp. A collection was made by Prof. Marcus E. Jones (No. 5241), May 16, 1894, at Springdale, Washington Co., alt. about 1200 m.

69. PUCCINIA JONESII Peck. I, III

On *Cogswellia lapidosa* (M. E. Jones) Rydb. (*Cymopterus lapidosus* Jones) I, collected by Professor Marcus E. Jones (Jones 7781), at Theodore, benches of the Uintas, Wasatch Co., May 12, 1908.

On *Cogswellia simplex* (S. Wats.) Rydb. (*C. platycarpa* (Torr.) Jones); *Lomatium platycarpum* (Torr.) Coulter & Rose. Collected by Professor Marcus E. Jones (Jones 1695), 1880. This collection is labeled "*Aecidium sublineatum* Pk. sp. nov." in Professor Jones' herbarium.

77. PUCCINIA MERTENSIAE Peck. III

On *Mertensia foliosa* A. Nels. Collected by Dr. J. F. Brenckle, May 7, 1918, at Red Butte, near Ft. Douglas, Salt Lake Co.

78. PUCCINIA MONARDELLAE Dudley & Thompson. I, II

On *Madronella oblongifolia* Rydb.: *2347*, August 24, 1917, Parley's Canyon, Wasatch Mts., Salt Lake Co. Collected by Garrett & Giddings.

81. PUCCINIA PIMPINELLAE (Str.) Mart. I, II

P. Osmorrhizae (Peck) Cooke & Peck.

On leaves of *Osmorrhiza occidentalis* Nutt.: *2257*, I, May 22, 1915, Red Butte Canyon, Wasatch Mts. *2254*, II, August 20, 1911, Abajo Mts., San Juan Co., alt. about 2000 m. Exsic. Fungi Utahenses *235*.

77 and 98. PUCCINIA MONTANENSIS Ellis

On *Elymus glaucus* Buckley. *2302*, III, Oct. 10, 1915, Red Butte Canyon, Salt Lake Co. Exsic. Fungi Utahenses *234*. The host was in a region where it had been surrounded by Hydrophyllum plants which had borne an abundance of aecia earlier in the year.

The specimens recorded in the first paper of "Smuts and Rusts of Utah" as No. 98: *Puccinia* sp. should be referred to *Puccinia montanensis*. It was suggested in the notes accompanying No. 98 that probably these collections (which sometimes have been called *Puccinia agropyrina* Ellis & Ev.) were connected with the Aecidium on the various species of Hydrophyllum. To test the correctness of this prediction (made in 1910), the writer sent to Dr. Arthur (on May 23, 1915) a fresh collection of aecia on *Hydrophyllum capitatum*, and requested that a sowing be made on Agropyron and Elymus. Dr. Arthur's inoculations were successful, uredinia beginning to show on Agropyron June 7, followed by telia June 11.

99. PUCCINIA ATRO-FUSCA (D. & T.) Holway

The rust designated under No. 99 of the "Smuts and Rusts of Utah" as *Puccinia* sp. should be referred to *Puccinia atro-fusca*.

Another collection was made at the same locality on August 24, 1917 (No. *2348*). Both collections were determined by Dr. Kern.

105. PUCCINIA SUBNITENS Dietel

On *Chenopodium murale* L. I, Collected May 6, 1918, at St. George, Washington Co., by E. M. Hall.

On *Atriplex rosea* L. (*A. spatiosa* A. Nelson) I. Collected July, 1916, at Oasis, Millard Co., by M. R. Porter.

The type collection of *Aecidium Sarcobati* Peck (which according to Dr. Arthur's cultures is one of the aecial forms of *P. subnitens*) was made by Professor Marcus E. Jones, June 23, 1880, at Milford, Beaver Co. Another collection was made by him (No. 7809), June 26, 1906, at Burbank, Millard Co. (alt. 1800 m.). Professor Bethel claims that this aecidium goes to *Puccinia luxuriosa* Sydow.

107. PUCCINIA SUBSTERILIS Ellis & Ev.

On *Eriocoma cuspidata* Nutt. (*Oryzopsis hymenoides* (R. & S.) Ricker): *2332*, Sept. 23, 1916, mouth of Red Butte Canyon, Salt Lake Co. This was formerly called *Uredo Eriocomae* Ellis. Altitude 1500 m. Exsic. Fungi Utahenses *240*.

124. PUCCINIASTRUM MYRTILLI (Schum.) Arth.

On *Vaccinium* sp. Collected by Professor Marcus E. Jones, August, 1883, in Strawberry Valley, Wasatch Mts.

On *Vaccinium globulare* Rydb. Collected by Dr. Hedgcock in Uinta Mts.

129. UROMYCES PUNCTATUS Schröt.

U. Astragali (Opiz.) Schröt.

On *Astragalus argophyllus* Nutt.: *2297*, July 22, 1915, Logan Canyon, Cache Co. (Host determined by Dr. Rydberg.)

131. UROMYCES INTRICATUS Cooke

U. Eriogoni Ellis & Hark.

On *Eriogonum ramosissimum* Eastw. Collected by Dr. P. A. Rydberg at Bluff, San Juan Co., August, 1911. Host determined by Dr. Rydberg.

132. UROMYCES PROEMINENS (DC.) Pass.

On *Euphorbia Greenei* Millsp.: *2402*, Duchesne, Duchesne Co., July 30, 1918. Host determined by Dr. Rydberg.

136. UROMYCES JUNCI-EFFUSI Sydow

This was listed as *Uromyces Junci* (Desm.) Lev. in the first paper of the "Smuts and Rusts of Utah," and was issued in

Fungi Utahenses under that name. *Uromyces Junci-effusi* has 3 or 4 germ-pores in the uredospores, while *U. Junci* has only 2.

143. UROMYCES ZYGADENI Peck

This species is listed in North American Flora (7^3: 241. 1912) as having been collected in Utah on *Zygadenus falcatus* Rydb.

The type of *Uromyces Zygadeni* was collected in City Creek Canyon, near Salt Lake City, by Professor Marcus E. Jones on *Zygadenus paniculatus.*

120. PUCCINIA WYETHIAE (Peck) Ellis & Ev.

A collection on *Wyethia arizonica* A. Gray was made by Professor Marcus E. Jones at Sink Valley, June 2, 1890.

123. PUCCINIASTRUM PUSTULATUM (Pers.) Dietel

On *Epilobium stramineum* Rydb.: *2363,* July 27, 1918, Witbeck's Ranch, near Vernal, Uinta Co.

148. COLEOSPORIUM RIBICOLA (Cooke & Ellis) Arth.

On *Ribes aureum* Pursh. Collected by Bethel & Hunt near Monticello, San Juan Co., August 15, 1918. The first record for the State on this host.

On *Grossularia inermis* (Rydb.) Cov. & Britt. Collected by Bethel & Hunt near Monticello, San Juan Co., August 15, 1918, the first record for the State on this host.

150. CRONARTIUM PYRIFORME (Peck) Hedgc. & Long. II, III
C. Comandrae Peck.

On *Comandra pallida* A. DC.: II. Collected by Professor Marcus E. Jones, August, 1883, at Salt Lake City. In Professor Jones' herbarium this collection is labeled "Uredo Commandrae Peck n. sp."—a name that evidently was never published. III, *2401a,* July 26, 1918, near Vernal, Uinta Co., alt. about 1665 m.

The connection of *Cronartium Comandrae* with *Peridermium pyriforme* Peck was demonstrated by Hedgcock & Long.

152. GYMNOSPORANGIUM GRACILENS (Peck) Kern & Bethel. III *G. speciosum* Peck.

On *Juniperus utahensis* (Engelm.) Lemm.: *2360*, Witbeck's Ranch, near Vernal, Uinta Co., July 27, 1918.

157. PUCCINIA ACTINELLAE (Webb) Syd. I

On *Actinella scaposa* Nutt. Collected by Professor Marcus E. Jones (No. 5290) at Cisco, Grand Co.

163. PUCCINIA GLOBOSIPES Peck

On *Lycium Andersoni* A. Gray: *2305*, June 11, 1915, Hat Island, Great Salt Lake. Host determined by Dr. Rydberg.

On *Lycium Torreyi* A. Gray. Collected by E. M. Hall at North St. George, Washington Co., May 17, 1918.

170. PUCCINIA PSEUDOCYMOPTERI Holw.

Mentioned in N. A. Uredineae (1: 91. 1913) as having been collected in Utah on *Pseudocymopterus anisatus* C. & R.

174. PUCCINIA TUMIDIPES Peck

On *Lycium pallidum* Miers. Collected by Dr. P. A. Rydberg, August 26, 1911, Cottonwood Creek, one mile northeast of Bluff, San Juan Co.; and by E. M. Hall, November 9, 1916, at Big Plains, Washington Co.

176. PUCCINIA VARIOLANS Hark.

On *Tetradymia canescens* DC. Collected by Professor Marcus E. Jones July, 1886, at Rockford.

On *Tetradymia comosa* A. Gray. Collected by Professor Marcus E. Jones May 16, 1915, at Temple Wash.

182. UROMYCES PSORALEAE Peck

The type of this species was collected by Professor Marcus E. Jones on *Psoralea* sp., June 4, 1880, alt. 1,300 m. Although stated in the original description as having been collected at Salt Lake City, Professor Jones tells me that it was collected "toward Garfield."

Mr. Wyatt W. Jones made a collection of this species in the aecial stage in Weber County.

184*. AECIDIUM ALLENII Clinton, Ann. Report N. Y. Museum 24: 93. 1872[2]

On leaves of *Shepherdia canadensis* Nutt. (*Lepargyraea canadensis* (L.) Greene): *2319*, August 21, 1916, Daniel's Canyon (above old millsite), Wasatch Co., alt. about 2,200 m. This is apparently the first record of this rust in the State. Exsic. Fungi Utahenses *226*.

Mr. Bethel connects this *Aecidium* with a coronate *Puccinia* on *Elymus* and *Agropyron*.

185*. AECIDIUM BIFORME Peck, Am. Nat. 9: 351. 1875

Collected in May, 1874, at St. George, Virgin Valley, Washington Co., by Dr. C. C. Parry. Bethel refers this to *Puccinia subnitens*.

186*. AECIDIUM LEPIDII Tracy & Gall., Jour. Mycol. 4: 21. 1888

Collected by Tracy & Galloway, July, 1887, type, on *Lepidium montanum* Nutt. Bethel refers this to *Puccinia subnitens*.

187*. CRONARTIUM OCCIDENTALE Hedg., Bethel & Hunt. I, II, III, Jour. Agr. Research 14: 413. 1918

On *Pinus edulis* Engelm.: F. P. 29419, I (*Peridermium occidentale* Hedg., Bethel & Hunt), McKee's Ranch, 15 miles northeast of Vernal, Uinta Co., July 28, 1918. This is the first record of the collection of the *Peridermium* in the State. Hunt and Bethel collected it at Monticello, San Juan County, on August 15, 1918.

On *Ribes aureum* Pursh. *2948*, II, III, September 14, 1918, Santaquin, Utah Co., alt. about 1428 m. The first collection in Utah of the *Cronartium* was made at Santaquin, September 19, 1914, by Professor C. P. Taylor on this same host.

On *Ribes odoratum* Wendl. (*R. longiflorum* Nutt.) III. Collected by Professor E. M. Hall at Springdale, Washington Co., November 10, 1916.

[2] Numbers marked with the asterisk (*) are those of species not included in either of the two preceding lists.

On *Grossularia inermis* (Rydb.) Cov. & Britt. (*Ribes inerme* Rydb.) II, III. Collected by Bethel & Hunt at Monticello, San Juan Co., August 15, 1918. This is the first collection on this host in the State, and the second in nature on this host.

188*. GYMNOSPORANGIUM BETHELI Kern. I, III, Bull. Torrey Bot. Club 34: 459. 1907.

On leaves and sparingly on fruits of *Crataegus rivularis* Nutt.: *2293,* July 22, 1915, Logan Canyon, Cache Co. Exsic. Fungi Utahensis *227*. Also reported by Dr. O'Gara on the same host from Parley's Canyon, Salt Lake Co.

On *Juniperus scopulorum* Sarg. Collected by Professor Ellsworth Bethel, November 11, 1917, at Gilluly Station (Tucker P. O.), Utah Co. Even at the late date on which this collection was made, a few telial horns still persisted.

189. GYMNOSPORANGIUM JUVENESCENS Kern. III, Bull. N. Y. Bot. Garden 7: 448. 1911

On *Juniperus scopulorum* Sarg. Collected by Professor Ellsworth Bethel, November 17, 1917, in Bullion Canyon near Marysvale, Piute Co. This species forms large witches' brooms on the cedar trees. The leaves in the fasciations become slender and sharp-pointed like those of the young growth. The aecia are found on *Amelanchier,* but have not yet been reported from Utah.

190*. GYMNOSPORANGIUM KERNIANUM Bethel. III, Mycologia 3: 157. 1911

On *Juniperus utahensis* (Engelm.) Lemm.: *2361,* July 27. 1918, Witbeck's Ranch, near Vernal, Uinta Co. Also collected by Professor Ellsworth Bethel, November 17, 1917, on the same host, in Bullion Canyon (three miles from Marysvale), Piute Co. This collection consists of only the fasciations made by the rust. These fasciations can be distinguished from those of *G. juvenescens* by the fact that the scales are altered only by becoming smaller instead of reverting to the sharp-pointed form of the younger growth, as they do in *G. juvenescens.*

191*. MELAMPSOROPSIS ARCTOSTAPHYLI (Dietel) Arthur. II

Chrysomyxa Arctostaphyli Dietel. Result. Sci. Congr. Bot. Vienne 338. 1906.

On *Arctostaphylos Uva-Ursae* (L.) Spreng. Collected by Professor Marcus E. Jones, August 2, 1894, at Fish Lake, Sevier Co., alt. about 3000 m.

This is a very rare rust, the other collections being two from Wisconsin, one from Colorado and one from Montana. The aecial connection is still to be discovered, and is to be looked for on the leaves and cones of the spruces.

192*. PERIDERMIUM COLORADENSE (Dietel) Arthur & Kern, Bull. Torrey Bot. Club **33**: 426. 1906.

Dr. Hedgcock states (Phytopathology **3**: 17. 1913) that many spruce trees diseased by this fungus were observed in the Manti National Forest. *Picea Engelmanni* is more often attacked than *Picea lasiocarpa*. Diseased trees can easily be told by the conspicuous witches' brooms made by the fungus.

193*. PUCCINIA ANOMALA Rost. Thüm. Flora **1877**: 92. 1877

P. Hordei Otth.

In his Uredinales of Oregon (page 231), Dr. Jackson states that specimens of this rust from Utah, on the leaves of the wild barleys, are in the Arthur herbarium.

194*. PUCCINIA CHRYSANTHEMI Roze. II, Bull. Soc. Mycol. de France **16**: 92. 1900.

On leaves of *Chrysanthemum* sp. cult. Collected November, 1915, at Salt Lake City, by Kenneth Robbins, a pupil in Botany at the Salt Lake High School.

195*. PUCCINIA COLLINSIAE P. Henn. I, Hedwigia **37**: 269. 1898

On *Collinsia parviflora* Dougl. Collected May 29, 1917, at Plain City, near the Hot Springs above Ogden, Weber Co., by Wyatt W. Jones, botanist of the American Smelter and Refining

Company's Experiment Station. A specimen of this collection was sent to Dr. Arthur for determination, and he puts it here provisionally.

196*. PUCCINIA CONSIMILIS Ellis & Ev. I, Jour. Myc. 6: 120. 1891

On leaves of *Sisymbrium incisum* Engelm. Collected by Professor Marcus E. Jones (No. 7788), at White River, Uinta Co., May 25, 1908, at an altitude of 1800 m.

197*. PUCCINIA GENTIANAE (Strauss) Link. II, III, Willd. Sp. Pl. 6²: 73. 1825

On *Gentiana affinis* Griseb.: *2307*, August 9, 1916, Barclay Station, Parley's Canyon, Salt Lake Co., alt. 1860 m. Collected by Garrett & Giddings. (Exsic. Fungi Utahenses *231*.) Also collected on this same host by Professor Marcus E. Jones (No. 2163), August 15, 1881, at Park City, Summit Co., alt. 2400 m.

On *Gentiana Amarella* L. II, III. Collected by Professor Marcus E. Jones (No. 5913), August 27, 1894, at Marysvale, Piute Co., alt. 1950 m.

198*. PUCCINIA GLUMARUM (Schmidt) Ericks. & Henn. II, Zeits. Pflanzenkr. 4: 197. 1894

Two collections recorded under No. 93 of this list (Mycologia 2: 293. 1910) as *Puccinia rubigo-vera* (Nos. *1010* on *Elymus glaucus* Buckl. and *2038* on *Hordeum jubatum* L.) should be referred to this species, as determined by Dr. H. B. Humphrey in Phytopathology 7: 143. 1917. These two collections were distributed in Fungi Utahenses under the numbers 138 and 191 respectively. Another collection also distributed in Fungi Utahenses (No. 192) as *P. rubigo-vera* was determined by Dr. Humphrey at the same time as referable to this species. This collection should be recorded as follows: On *Hordeum pusillum* Nutt.: *2083*, August 26, 1909, Parley's Park, Parley's Canyon, Salt Lake Co.

Dr. O'Gara has reported in Science N. S. 44: 610. 1916, the

occurrence of this rust in wheat fields north and west of Ogden.

The aecial stage of this rust has never been discovered.

199*. PUCCINIA LUXURIOSA Sydow. III, Monog. Ured. **1**: 812. 1904

On *Sporobolus airoides* Torr. Collected by Ellsworth Bethel, Nov. 15, 1917, at Marysvale, Piute Co. According to Professor Bethel, the aecial stage of this rust is found on *Sarcobatus vermiculatus,* given in this list as the aecial stage of *Puccinia subnitens,* No. 105. (Mycologia **6**: 245. 1914.)

200*. PUCCINIA OENOTHERAE Vize, Grev. **5**: 109. 1877

On leaves of *Sphaerostigma Utahense* Small: 2304, June 11, 1916, Carrington Island, Great Salt Lake, Tooele Co., alt. 1265 m. Not before reported on this host.

201*. PUCCINIA PATRUELIS Arthur. II. Mycol. **1**: 245. 1909

On *Carex* sp.: *2168*, July 12, 1911, Gold Basin, La Sal Mts., San Juan Co., alt. about 2878 m.

In his Uredinales of Oregon, Dr. Jackson uses the combination *Puccinia hieraciata* (Schw.). Jackson for this rust.

202*. PUCCINIA SWERTIAE Wint. I, Rabh. Krypt. Fl. **1**: 205. 1881

On leaves of *Swertia Fritellaria* Rydb.: *2292*, July 13, 1915, west bank of Silver Lake, Big Cottonwood Canyon, Salt Lake Co. Alt. 2615 m. This is apparently the first recorded collection of this species on this host, as well as the first collection of the rust in the State.

EXSICCATI Fungi Utahenses *241*.

203*. UROMYCES FUSCATUS Arthur. I, ii, III, Bull. Torrey Club **45**: 142. 1918

On *Polygonum alpinum* All.: *2286*, June 29, 1915, mountainside south of Gogorza Station, Parley's Canyon, Summit Co. Alt. 1900 m.

EXSICCATI: Fungi Utahenses *244*.

204*. UROMYCES PROBUS Arthur. I, Bull. Torr. Club 38: 376. 1911

On *Sisyrinchium grandiflorum* Dougl.: Collected by Professor Marcus E. Jones, April 1, 1887, at Tooele, Tooele Co. This is labeled *Aecidium Sisyrinchi* in Professor Jones' herbarium, a name that apparently was never published.

205*. UROMYCES SOPHORAE Peck.

Professor Jones reports having collected this rust in southeastern Utah. I have not seen his specimens.

EAST HIGH SCHOOL,
SALT LAKE CITY, UTAH.

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor*]

Professor W. P. Fraser, formerly of Macdonald College, Province of Quebec, has been called to the University of Saskatchewan at Saskatoon.

Professor H. M. Fitzpatrick, of Cornell University, is engaged during the summer in field investigation of the potato wart disease for the Bureau of Plant Industry.

Nineteen new species of *Galerula* are described by Atkinson in the *Proceedings of the American Philosophical Society* **57**: 357–379. 1918.

The citrus diseases occurring commonly in Florida are treated by H. E. Stevens in Bulletin 150 of the Florida Experiment Station, which contains about 100 pages of text and 49 figures.

A new bacterial disease causing angular leaf-spot of tobacco was described by F. D. Fromme and T. J. Murray in the *Journal of Agricultural Research* for February 24, 1919.

Several new species of bacteria have been isolated from diseased portions of orchids by G. L. Pavarino, who publishes his discoveries in Atti Ist. Bot. Univ. Pavia **15**: 81–88. 1918.

Dr. J. C. Arthur publishes in the *Torrey Bulletin* for April, 1919, a number of new species of rusts, about 16 in all, from various parts of North America.

The fungous diseases attacking the persimmon in Japan are treated by T. Tanaka in the Mo. Bull. Cal. Com. Hort. **7**: 461–463. 1918.

Professor H. S. Jackson contributed a number of articles to recent volumes of the *Proceedings of the Indiana Academy of Sciences* on the Smuts and Rusts of Delaware and Indiana. These papers contain a great deal of valuable information.

An article on a wilt disease of maples, by L. A. Zimm, appeared in *Phytopathology* 8: 80, 81. 1918. This disease is said to cause the young shoots of several common species of maples to lose their leaves and gradually die.

A descriptive list of the diseases of sugar-cane in tropical America, by J. R. Johnston and others, appeared in the *West Indian Bulletin* for 1918, pages 275 to 308. The list is a long and important one and what is there reported may be considered quite authoritative.

It is reported that because of the similarity of climate and soil conditions of Texas and the land upon which the Jewish "Republic of Judea" will be built, the Zionist Society has retained Dr. J. J. Taubenhaus, plant pathologist of the Texas Agricultural Experiment Station, for a high agricultural post in the new nation.

A list of unreported fungi for 1915 and 1916, by C. H. Kauffman, has appeared as a reprint from the 19th report of the Michigan Academy of Sciences. This list, which is quite a long one for certain families, has appended to it an index to the hosts and woody substrata of hymenomycetes in Michigan.

A text-book entitled "Applied Economic Botany," by Dr. Mel. T. Cook, has just appeared from the press of the J. B. Lippincott Company. In the 261 pages of text illustrated with 151 figures, there is a chapter on plant diseases which gives in very condensed and simple form some of the most important facts regarding this highly specialized subject.

An important paper on the Parasitism, Morphology, and Cytology of *Cronartium ribicola*, by R. H. Colley, appeared in the *Journal of Agricultural Research* for December 23, 1918. The article is illustrated with several halftones and many beautiful microscopic drawings.

In a paper on *Arcangeliella, Gymnomyces,* and *Macowanites* in North America, contributed by Zeller and Dodge to the *Annals of the Missouri Botanical Garden* for February, 1919, *Arcangeliella caudata, Gymnomyces Gardneri,* and *Macowanites echinosporus,* all from California, are described as new.

"Winter Botany" is a handy little volume written and published by Professor William Trelease in 1918, containing 394 pages of description and numerous text figures, enabling one to identify hardy plants in the winter season. This volume will be helpful especially to mycologists who are collecting fungi in the autumn and spring.

A revision of the Argentine Laboulbeniales by Spegazzini appeared in the *Anales del Museo Nacional* 29: 445–688. 1917, a copy of which has just been received at the Garden library. The treatment of this group is very extensive and thorough, with carefully drawn descriptions and excellent text figures of 213 species, many of which are new.

A bulletin on the potato wart disease mentioned in MYCOLOGIA for January has recently been prepared by C. R. Orton and F. D. Kern of the Pennsylvania State College. The authors recommend a strict quarantine to prevent this very serious disease from being introduced into other localities.

A very extensive paper on the biology of *Polyporus pargamenus* Fries, by Arthur S. Rhoads, appeared last year as Technical Publication No. 11 of the New York State College of Forestry. In it this extremely common and widely distributed fungus is thoroughly discussed, described, and figured. The paper contains 197 pages of text and 31 plates.

The heart-rot of Western Hemlock is discussed by J. R. Weir and E. E. Hubert in Bulletin 722 of the U. S. Department of Agriculture. The fungus causing this disease, *Echinodontium tinctorium,* is ordinarily known as the Indian paint fungus, because of its use by the Indians of the Northwest for war paint. The authors suggest cutting the infected trees and destroying by fire all material that might disseminate the spores of the fungus.

An article on the wet-rot of Para rubber roots, by W. N. C. Belgrave, forms the subject of Bulletin No. 28 of the Department of Agriculture of the Federated Malay States. This disease, formerly attributed to *Poria hypolateritia,* is now said to be caused by *Fomes pseudo-ferreus.* The treatment of trees affected by this fungus is said to be of little use. Prevention by clean clearing of jungle stumps is recommended.

A new species of Amanita, *A. mutabilis,* is described by Beardslee in the March number of the *Journal of the Elisha Mitchell Scientific Society,* as occurring in white sand on Davis Island, North Carolina. The characters of this species are said to suggest a relationship to *A. pantherina* and *A. cothurnata.* The pileus is white or pale-yellowish and the context of the stipe changes to carmine in about three minutes.

An interesting account of the Physoderma disease of corn, by W. H. Tisdale, appeared in the *Journal of Agricultural Research* for February 3, 1919. This disease occurs throughout the United States as far westward as Texas and Nebraska and northward to southern Minnesota and New Jersey, considerable damage having been done in the Atlantic and Gulf coast states and in the Mississippi valley.

Dr. W. C. Coker has published another one of his valuable, handsomely illustrated articles on larger fungi of North Carolina. This article is entitled "The Hydnums of North Carolina." Almost the entire March number of the *Journal of the Elisha Mitchell Scientific Society* is devoted to this interesting group of

fungi. There are many illustrations, two of them being colored plates. Banker's nomenclature is followed in the main. Three species are described as new, *Hydnellum ferrugipes, Hydnellum carolinianum*, and *Phellodon Cokeri.*

A popular article on cedar rust, by Dr. F. D. Fromme, of the Virginia Agricultural Experiment Station, appeared in the report of the twenty-third annual session of the Virginia State Horticultural Society. Dr. Fromme says: "Cedar eradication is the cheapest form of orchard insurance you can buy. The cost on the average is less than the cost of a single spray application. Cut down the cedars and you will realize the benefits. There are thousands of cedars waiting for the axe."

The development of *Stropharia epimyces* is the subject of an article by W. B. McDougall in the March number of *The Botanical Gazette.* This very interesting fungus has been placed in several genera and the fact that it always occurs as a parasite on another mushroom lends added interest to it. Regarding its identity with *Pilosace algeriensis,* as suggested by Harper, the author says: "While it is entirely possible that this may be true, our plant cannot belong to *Pilosace,* as we understand that genus, since it has an annulus and the lamellae are not free."

Several parts of Dr. Kauffman's work on the fungi of Michigan have recently appeared as reprints from Publication 26 of the *Michigan Geological and Biological Survey.* The genera treated in these reprints are *Cortinarius, Lepiota, Clitocybe, Hygrophorus, Collybia, Russula, Pholiota, Amanita*, and *Coprinus,* the last genus having been contributed by Professor Pennington. The plates to accompany Dr. Kauffman's work will not appear until the entire publication is issued. These papers contain few new species except in the genus *Cortinarius,* to which about a dozen are added.

The "Manual of Tree Diseases," by Dr. W. H. Rankin, has recently been issued by The Macmillan Company. It is a volume of about 400 pages, illustrated with 70 figures. The various diseases are classified under the trees on which they occur and the

trees are arranged in alphabetical order. Subjects of a general nature are treated in the first part of the book. The author's training and experience enable him to speak with authority and this work may be recommended without reservation to mycologists, foresters and others interested in this very far-reaching and important subject.

Professor Guy West Wilson recently sent in from Clemson College, South Carolina, a specimen of *Daedalea juniperina*, collected on a red cedar trunk on the campus. The tree had been pruned and was seriously infected with the fungus on a number of the pruning wounds. This rare species of *Daedalea* was described from specimens collected at Rockport, Kansas, and was afterwards found in Missouri. Another rare fungus collected by Professor Wilson at Clemson College is *Coltriciella dependens*, which he found growing inside a rotten oak log. This species had been previously known from specimens collected on decorticated pine wood in the Carolinas and on yellow poplar wood in Florida.

Bulletin 707 of the U. S. Department of Agriculture is of peculiar interest to mycologists who have charge of herbaria because it gives the results of numerous experiments undertaken by the Bureau of Entomology with miscellaneous substances employed in destroying various insects. Among the substances used, napthalene proved effective in preventing infestation and in killing all stages of insects. Camphor did its work more slowly, while red cedar chips and pyrethrum powder were only moderately effective. The results here outlined support our own conclusions, derived from experiments and practical experience over a long period of years, that napthalene flake is the best insecticide for the herbarium of larger fungi.

In a recent paper by W. B. McDougall in *The Plant World* on the classification of symbiotic phenomena, the following statement appears: "Probably no one will dispute the status of lichens but some may object to speaking of lichens as symbiotic phe-

nomena at all, since some prominent botanists have recently adopted the rather peculiar notion that lichens are simply fungi. The word lichen, however, has been used for a long time to mean the composite structure that results from the symbiosis of lichen-fungi with algae, and no very good reason has yet been given for changing its meaning. A lichen-fungus is a fungus; it is not a lichen. There is no more reason for calling a lichen a fungus than there is for calling a mycorhiza a fungus; and it is just as absurd to call a lichen-fungus a lichen as it would be to call a mushroom a mycorhiza."

BAHAMA FUNGI

Mr. L. J. K. Brace has been sending in a number of fungi of late, collected by him in the Bahamas. Most of the more conspicuous species in his collections are quite widely distributed in tropical America, but the following are worthy of note, especially because very little mycological work has been done in these islands:

Hypochnus spongiosus, Septobasidium cirratum, Stereum candidum, Merulius corium, Coriolus abietinus, Coriolus sericeohirsutus, Fulvifomes dependens, Fulvifomes Swieteniae, Ganoderma pulverulentum, Inonotus fruticum, Inonotus porrectus, Trametes submurina, Tyromyces palustris, Chlorophyllum molybdites, Gymnopilus tenuis, Resupinatus subbarbatulus, Stropharia floccosa, Cyathus pallidus, and *Diplocystis Wrightii.*

Polyporus Bracei sp. nov.

Pileus flabelliform to circular, depressed, thin, usually cespitose, 8–15 cm. broad, larger by confluence; surface covered with fine tomentum scarcely visible to the unaided eye, somewhat uneven, azonate, uniformly dirty-white to pale-isabelline-avellaneous, margin thin, often undulate or lobed; context soft and punky, but fragile, homogeneous, pale-yellowish, 1–5 mm. or more thick; tubes decurrent, dirty-white, turning darker when bruised, scarcely 1 mm. long, mouths very minute, irregular, variable, 4–6 to a mm.; spores ellipsoid, smooth, hyaline, minute; stipe normally central, short, enlarged at the base, colored and clothed like the pileus where not covered with whitish mycelium, reaching 3 cm. long and 2 cm. thick, sometimes reduced to a mere tubercle.

Type collected in New Providence, Bahamas, in the autumn of 1918, by L. J. K. Brace.

HABITAT: On the ground, attached to sticks and buried wood.
DISTRIBUTION: Known only from the type locality.

W. A. MURRILL

A NEW SPECIES OF LENTINUS FROM MINNESOTA

Splendid specimens of an interesting species of *Lentinus* were received for determination in August, 1917, from Dr. E. M. Freeman, who wrote me, as follows:

> "The specimens were collected at Itasca Park (Lake Itasca), Minn., on a large old log which was not identified, but probably was a conifer of some sort. The sporophores varied from four to eight (or ten) inches across and were almost uniformly flesh-colored all over. They had a very pleasant odor, somewhat resembling pineapple. They had the general appearance of a *Lentinus* with the rooting base, and the specimens which I am sending in a separate package show their non-putrescent character. The branching and anastomosing of the gills was very marked, while the teeth on the gill edge were very inconspicuous. The sporophores grew in a cluster. They have been partially eaten by squirrels or other animals. I have never seen this fungus before, although I have collected at this park for almost ten years."

Being unable to recognize Dr. Freeman's plant or to associate it definitely with any known herbarium specimen or description, I have decided to publish it as new and to dedicate it to the discoverer.

Lentinus Freemanii sp. nov.

Pileus very large, circular, plane, cespitose, 10–20 cm. or more broad; surface dry, finely hispid-tomentose, uniformly dark-rosy-isabelline when fresh, becoming somewhat paler on drying; context white, unchanging, reaching 4 cm. in thickness near the center, eaten by squirrels or other animals, having a pleasant odor resembling that of pineapples; lamellae long-decurrent, thin, very narrow and very crowded, branched and anastomosing, rosy-isabelline, becoming dark-purplish-brown when bruised, very slightly dentate on the edges, usually splitting into plates or lacerate with age; spores narrowly-oblong, usually curved and pointed at one end, smooth, hyaline, $9–11 \times 3.5\,\mu$; stipe central, curved, solid, rather slender, usually enlarged near the base and expanding into the pileus at the apex, clothed and colored like the pileus where not covered with decurrent lamellae, 8–15 cm. long, 2–4 cm. thick.

Type collected at Itasca Park, Minnesota, August, 1917, by E. M. Freeman.

HABITAT: On an old log, probably of a conifer.

DISTRIBUTION: Known only from the type locality.

W. A. MURRILL

FUNGI FROM ECUADOR

In the autmun of 1918, Dr. J. N. Rose collected a number of woody and fleshy fungi in Ecuador and sent them to the Garden for determination and distribution. Most of the gill-fungi were small, poorly preserved, and without notes, but the woody forms came through in very good condition. *Pyropolyporus inflexibilis*, from Portovelo, and *Cookeina sulcipes*, from Bucay, were represented by single specimens that could not easily be divided. Three sets were made of the species listed below, one going to Washington, one to Harvard, and one remaining here. The great majority of these species were collected in the vicinity of Huigra; several at Ventura and Bucay; and a few at Portovelo, Loja, Durán, Cumbe, Cañar and Tablón de Oña.

Species deserving special mention are: *Gymnopus tenuipes* (Huigra); *Crepidotus calolepidoides* (Tablón de Oña); *Fomes subferreus* (Cañar); *Trametes lignea* (Huigra), previously known only from one collection made in Nicaragua; and *Lentinus hirtiformis* (Ventura), previously known only from British Honduras. The specimens of this last species obtained by Dr. Rose in Ecuador are much larger than the types, and the stipes are covered with a brown, velvety tomentum.

SPECIES DISTRIBUTED

Auricularia Auricula
    nigrescens
Coriolopsis occidentalis
    rigida
Coriolus maximus
    pavonius
    versicolor
Crepidotus calolepidoides
Daedalea amanitoides
Earliella corrugata
Elfvingia tornata
Favolus tenuis
Fomes subferreus
Fomitella supina
Gloeoporus candidus
Gymnopus tenuipes
Hapalopilus gilvus
    licnoides
Hymenochaete Sallei
Lentodiellum concavum
Lentinus crinitus
    hirtiformis
Pogonomyces hydnoides
Polyporus tricholoma
Pycnoporus sanguineus
Rigidoporus surinamensis
Schizophyllus alneus
Trametes lignea

W. A. MURRILL

QUEER FUNGOUS GROWTHS

The peculiar growth figured herewith was sent to me last November by Dr. J. J. Taubenhaus, of the Texas Agricultural Experiment Station, who obtained it from Mr. J. S. Watson, of Stephenville, Texas. Mr. Watson says that this growth, known locally as "oil bloom" or "gas stool," appears in the springtime year after year on a small area of land where gas has been found. "It is in no way connected with any kind of timber," writes Mr. Watson, "as it grows out in the open on a farm which has been in cultivation for quite a number of years; and is on high, dry, sandy land; and it grows above the surface and is not plowed up; and there is no weed growth of any kind that grows with it. Some of the stools are very much larger than the

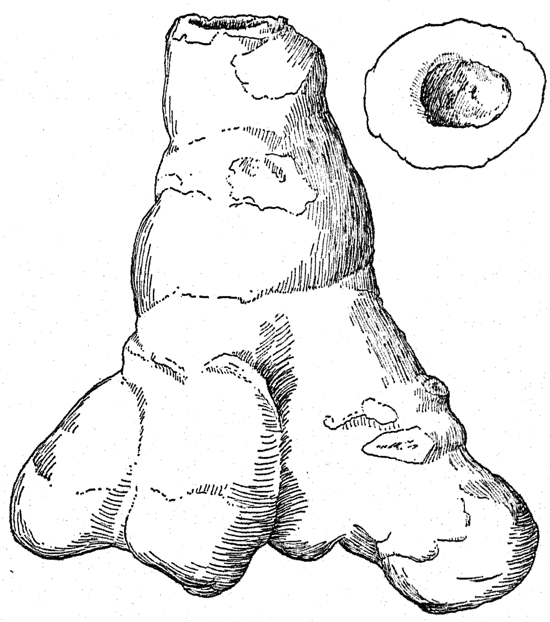

FIG. 1. A specimen of "oil bloom" from Texas, one-half natural size.

ones I sent, and when they are forming they look very much the color of Baumont crude oil."

Peculiar sterile forms like these should be studied where they occur by a competent mycologist, but a brief discription can do

no harm and some conjectures as to their probable nature and origin may be of sufficient interest to lead to further investigation.

I have two specimens, one simple and the other branched as shown in the figure, so as to resemble a clumsy foot of bird or beast with two double toes. The branched one shows four zones of growth, and, about an inch from the tips of the spreading "toes," the color changes from uniform dark-avellaneous with a brownish tint to dirty-white with here and there a creamy tint, which is also the color of the interior. If there is a cortex, it is very thin and chiefly distinguished by the change in color, but there is a definite tendency in the growths to take definite shape and limit their development both laterally and longitudinally.

These growths are heavy and almost entirely composed of sand, which may be felt over the whole surface and seen under a hand lens intimately mixed with fungous mycelium. The central core is free from sand, being composed of the decayed remains of a root or other form of vegetable matter showing large vascular elements. Sand is also absent from the growing tips of both specimens in one or two limited areas where the mycelium has massed on the surface in a thin white layer or in the form of brown punky tissue as though a fruiting surface of some kind were about to be formed.

It is probable that these masses of mycelium developed in association with roots surrounded by sand, which was intimately included by the mycelium as it grew. It may be that the sand was moist when the growths developed and afterwards became dry and shifted so as to reveal the growths. Forms similar to these often occur in mines and other dark places where developing sporophores are seeking the light; the darkness causing them to remain sterile and very abnormal in form and color. The Tuckahoe is an underground sclerotium, or mass of resting mycelium, which sends up a sporophore when the proper time arrives and the conditions are suitable.

W. A. MURRILL

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Chytridium codicola, *Rhizophidium codicola* and *Stemphylium Codii*, spp. nov. are described.

MYCOLOGIA

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SOME DESCRIBED SPECIES OF PORIA

WILLIAM A. MURRILL

The brown and black species of this group have already been treated in *North American Flora* and one genus, *Xanthoporia,* was recently described in *Mycologia.* The resupinate polypores are particularly difficult for several reasons. In the first place, they lack the definite shape which is often a determining character in the pileate forms; they are, moreover, entirely destitute of a "surface," with the various important characters which it usually affords; and they are mostly small, the characters that are present being necessarily on a small scale.

As a rule, each individual specimen has to be examined with the microscope, and, even then, the well-known variability in microscopic characters often leaves one in doubt. In working with original specimens in foreign herbaria, it is often impossible to get satisfactory results because of the character of the work required and the time it consumes. Accidental resupinate forms among pileate species also give considerable trouble because of their close resemblance to forms uniformly resupinate, and for this reason a wide and accurate knowledge of pileate forms is essential.

The white and bright-colored resupinates are more difficult than the rest because there are more species with fewer characters, more confusion with pileate forms, and less chance of obtaining spore characters. Specimens found in the herbaria are almost invariably without notes, as well as without good spores, so that the preparation of adequate descriptions must be

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left to those having access to fresh specimens or to recently collected material.

Herbarium specimens are also badly mixed and it is necessary in nearly all cases to get at the actual types for comparison. Histological studies and enlarged drawings from type material may be interesting and helpful but they can never take the place of the types themselves. What we need is an abundance of carefully collected and described fresh material closely compared with originals and distributed to all the principal taxonomic centers for the use of students in identification. We thought that the pileate polypores were sufficiently confused in American collections, but the resupinates are many times worse.

1. **Poria humilis** nom. nov.

Polyporus incrustans Berk. & Curt.; Berk. Grevillea **1**: 54. 1872.
Not *P. incrustans* Pers. Myc. Eur. **2**: 93. 1825.
Poria incrustans Sacc. Syll. Fung. **6**: 330. 1888.

"Mollis, albus; quisquilias incrustans; mycelio gossypino; poris brevibus angulatis; dissepimentis tenuibus. No. 5671. New England. Murray.

"Running over grass and various substances, after the fashion of *Thelephora sebacea;* white, soft, springing from a thin cotton-like mycelium; pores 1/80 inch wide, short, angular, with thin dissepiments."

Described from specimens collected in New England by Murray and still to be seen at Kew. The tubes are rather primordial.

2. **Poria elachista** (Berk.) comb. nov.

Polyporus minimus Rav.; Berk. Grevillea **1**: 65. 1872. Not *P. minimus* Fries. 1838.
Polyporus elachista Berk.; Cooke, Grevillea **15**: 57. 1886.

"Pulvinatus fere totus e poris mollibus ceraceis candidis elongatis minimis constitutus. No. 2988. Car. Inf.

"Only one or two lines across, forming little cushions, consisting almost entirely of very minute, elongated, wax-like pores."

Type from South Carolina by Ravenel. Only four small fragments were to be seen at Kew, and these were of little use. A

specimen so named in the Desmazières collection at Paris proved to be *Coriolellus sepium.*

3. PORIA SALVIAE (Berk. & Curt.) Sacc. Syll. Fung. **6**: 311. 1888

Polyporus Salviae Berk. & Curt.; Berk. Grevillea **1**: 54. 1872.

"Effusus, mollis, albus, fere totus é poris minimis flexuosis constitutus; dissepimentis tenuibus. No. 2602. Car. Inf. On *Salvia,* surrounding the branches, consisting almost entirely of the minute flexuous pores; dissepiments thin; pores $1/100$ inch in diameter. Allied to *P. vaporarius.*"

Type from South Carolina by Ravenel on sage. Seen at Kew and also in the Ellis Herbarium. An abnormal, cellular form almost devoid of context.

4. PORIA CANDIDISSIMA (Schw.) Sacc. Syll. Fung. **6**: 310. 1888

Polyporus candidissimus Schw. Trans. Amer. Phil. Soc. **4**: 159. 1832.

"P. effusus; membrana tenuissima, bombycina, sed tamen detrahenda. Poris maximis demum obliquis, cum membrana candidissimis. Ad Polystictas pertinere videtur, sed membrana detractabilis obstat."

Type from Bethlehem, Pennsylvania, by Schweinitz, on decayed wood. At Philadelphia but not at Kew. Thin, white, like a cobweb, with a shallow network of tubes resembling holes in a veil.

5. PORIA CALCEA (Schw.) Sacc. Syll. Fung. **6**: 330. 1888

Polyporus calceus Schw. Trans. Amer. Phil. Soc. **4**: 159. 1834.

Known only from specimens collected on a fallen trunk in Bartram's garden, Philadelphia. Schweinitz thought these specimens the same as *Polyporus vulgaris calceus* Fries, Syst. Myc. **1**: 381. 1821, which variety he considered sufficiently distinct to deserve specific rank. The American plant, however, has no such close connection with the plant known to Fries. *Poria calcea* Berk. & Br. was used later for a Ceylon species.

6. PORIA INTERNA (Schw.) Sacc. Syll. Fung. **6**: 293. 1888

Polyporus internus Schw. Trans. Amer. Phil. Soc. **4**: 159. 1832.

"P. longitudinaliter penetrans in cavitatibus trunci putridi varie flexuosus ad 3–4 uncias, primo molluscullus, crassus margine demum inflexo. Tubis saepe obliquis longioribus. Poris flexuosis minutis. Color totus albus, nisi statu sicco subpallescit."

Type from Bethlehem, Pennsylvania, by Schweinitz, on the interior of trunks. Said to be frequent. Still to be seen at Kew.

7. PORIA XANTHOLOMA (Schw.) Sacc. Syll. Fung. **6**: 324. 1888

Polyporus xantholoma Schw. Trans. Amer. Phil. Soc. **4**: 158. 1832.

"P. effiguratim effusus, tenuissimus, margine membranaceo fimbriato, latiusculo, sterili, eleganter luteo. Poris superficialibus, parietibus crassiusculis, subsinuosis, minutis, pallidis. Plagas 1–2 unciales irregulares efformat, ligni inaequabilitatem forma sequens."

Type from Salem, North Carolina, by Schweinitz, on decayed wood. Several things are referred to this species at Kew, all of which may be different from the type at Philadelphia.

8. PORIA LIMITATA (Berk. & Curt.) Sacc. Syll. Fung. **6**: 324. 1888

Polyporus limitatus Berk. & Curt.; Berk. Grevillea **1**: 54. 1872.

"Totus resupinatus rigidus allidus; margine nigrescente rimoso; poris angulatis. No. 2686. Car. Inf. Entirely resupinate, the margin thin, barren, and cracked. Pores 1/70 inch wide.

Described from specimens collected on dead trunks in South Carolina. The tubes seem rather primordial and inclined to be rigid. Compare *P. tenuis*.

9. PORIA TENUIS (Schw.) Sacc. Syll. Fung. **6**: 331. 1888

Polyporus tenuis Schw. Trans. Amer. Phil. Soc. **4**: 159. 1832.

"P. longe longitudinaliter effusus, membranam sistens tenuem subdetrahendam albo-pallentem aequabilem margine substerili albidiori. Poris majusculis subflexuosis, parum excavatis pallidis."

Type from Bethlehem, Pennsylvania, by Schweinitz, on the interior fibrous bark of chestnut. Well preserved at Philadelphia. Compare *P. limitata*.

10. PORIA SASSAFRAS (Schw.) Sacc. Syll. Fung. **6**: 294. 1888

Polyporus Sassafras Schw. Trans. Amer. Phil. Soc. 4: 158. 1832.

"P. substantia molliuscula, bibula; subiculo vix in margine conspicuo; tubis in centro satis elongatis, crassiusculis. Poris minutis, regulariter rotundis. Longitudinaliter in ligno ac cortice effusus (colore pallide lutescente) ad 1–2 uncias."

Type from Bethlehem, Pennsylvania, by Schweinitz, on much decayed sassafras wood. Seen at Philadelphia. Said to be frequent.

11. PORIA ALABAMAE (Berk. & Cooke) Sacc. Syll. Fung. **6**: 323. 1888

Polyporus Alabamae Berk. & Cooke; Berk. & Curt. Grevillea **6**: 130. 1878.

"Effusus, determinatus, lobatus, albus, exsiccate ochraceus, marginque albo floccoso; poris minoribus, subrotundis.

"The distinct, barren, floccose margin is broad when young, but diminishes with age; it is nevertheless always distinguishable as a paler marginal zone."

Described from specimens collected at Gainesville, Florida, by Ravenel on branches of *Myrica cerifera*. See Rav. Fungi Am. Exsic. *110*. Well preserved at Kew. Collected in abundance in Florida by Calkins and also in Mississippi by Tracy. The spores have been described as elongate-ellipsoid, smooth, thin-walled, hyaline, $11 \times 4.5\,\mu$.

12. PORIA CINCINNATI Berk.; Cooke, Grevillea **15**: 27. 1886

"Effusa, ochraceo-pallida, tenuis, subtomentosa, margine extremo elevato, poris magnis, concavis, inaequalibus, rotundato-angulatis, dissepimentis brevibus, obtusis, hinc illic suppressis."

Type from Cincinnati, Ohio, by Lea, on bark. Characterized by large and unusually shallow tubes. Specimens at Kew were at first called *P. tenuis* Schw., which is quite a different plant.

13. Poria pulchella (Schw.) Sacc. Syll. Fung. 6: 323. 1888

Polyporus pulchellus Schw. Trans. Amer. Phil. Soc. 4: 158. 1832

"Rarior Bethlehem, olim *xanthus* mihi; cortice increscit.

"P. resupinato-effusus, superficie inaequali, subplicata, rugosa, ambitu determinatus; margine undulato tumido, substerili. Poris minutis, regularibus, angustatis, tubus subobliquis in rugis superficiei.

"Totus fungus flavescens, durus, siccus, uncialis."

Type from Bethlehem, Pennsylvania, by Schweinitz, on bark. Well preserved at Philadelphia and Kew. According to Bresadola, this is only a variety of *Poria medullapanis,* but I can hardly concur in his opinion. Specimens so named in Peters' collection from Alabama have much thicker dissepiments.

14. Poria Caryae (Schw.) Sacc. Syll. Fung. 6: 306. 1888

Polyporus Caryae Schw. Trans. Amer. Phil. Soc. 4: 159. 1832.

"P. junior tuberculoso-elevatus, interruptus, substantia spongiosa-tomentosa, margine sterili saepe tumido. Demum late effusus, magis aequabilis et subindurescens, margine tunc tenuissimo, submembranaceo, candido, praeditus. Tubis brevibus, parietibus crassiusculis, poris minoribus subrotundis et subflexuosis; interdum regulariter effusis, interdum pulvinatim in tuberculos elevatis. Ex fuliginis cinerascit. Ad pedalem longitudinem sub trunco effusus."

Described from specimens collected by Schweinitz at Nazareth, Pennsylvania, on a fallen hickory log. Types are well preserved at Philadelphia and Kew.

15. Poria Beaumontii Berk. & Curt.; Cooke, Grevillea 15: 26. 1886

"Effusa, adnata, crassiuscula, ochraceo-pallida, margine angusto subtomentoso, poris majusculis, subaequalibus, rotundo-angulatis, dissepimentis acie acutis, integris."

Type from Alabama, by Beaumont, on wood. The type sheet at Kew contains two collections from Alabama by Beaumont. Our No. 429 is *Coriolopsis rigida,* different from that sent to Kew. Compare *P. omoema.*

16. PORIA OMOEMA Berk.; Cooke, Grevillea **15**: 26. 1886

"Effusa, ochraceo-alba, rigida, e mycelio tomentosa albida constipata, subtus villosa; poris mediis ($\frac{2}{5}$–$\frac{1}{3}$ mm.), angulatis, integris, plerumque obliquis.—*Polyporus omoemus,* Berk. in Herb. No. 2837, *P. radula,* Rav. Amer. Exs. No. 107."

Type from South Carolina, by Ravenel, on trunks of pine. In good shape at Kew. Compare *P. Beaumontii.*

17. PORIA TOMENTO-CINCTA Berk. & Rav.; Cooke, Grevillea **15**: 26. 1886

"Effusa, adnata, subrigida, ochraceo-pallida, margine subtomentoso, poris majusculis, rotundatis, aequalibus, dissepimentis crassiusculis, acutis."

Type from Aiken, South Carolina, by Ravenel, on oak bark. See Rav. *1771.* Also from Darien, Georgia, by Ravenel, on oak (see Rav. Fungi Am. Exsic. *215*), Colorado, by Bethel, on dead wood, and New Jersey, by Ellis, on maple bark. Compare *P. holoxantha* and *P. dryina.*

18. PORIA HOLOXANTHA Berk. & Cooke; Cooke, Grevillea **15**: 26. 1886

"Orbicularis, dein confluens effusaque, ochraceo-pallida, adnata, subrigida, poris majusculis, subaequalibus, rotundatis, dissepimentis tenuibus, margine acutis.—*Polyporus holoxanthus,* Berk. and Cooke in Rav. Amer. Fungi No. 213–214, Herb. Berk. No. 2848.

"Pores smaller than in *P. omoema.* Some of these American species are doubtfully distinct."

Type from Darien, Georgia, by Ravenel, on oak. See Rav. Fungi Am. Exsic. *214.* Specimens from the same locality on *Myrica* were considered a variety when the exsiccati were issued (see Rav. Fungi Am. Exsic. *213*), but there is no reference to this distinction in the published description. Compare carefully with *P. tomento-cincta* and *P. dryina.*

19. PORIA DRYINA (Berk. & Cooke) Sacc. Syll. Fung. **6**: 315. 1888

Polyporus dryinus Berk. & Cooke; Berk. & Curt., Grevillea **6**: 130. 1878.

"Effusus, innatus, albidus, demum ochraceus; mycelio floccoso, albo; poris quandoque subrotundis, quandoque angulatis et inaequalibus, in stratum persistens constipatis; dissepimentis tenuibus."

Type from Aiken, South Carolina, by Ravenel, on oak branches. See Rav. Fungi Am. Exsic. *111*. Also seen at Kew, where it is somewhat mixed. Berkeley's remark about its "resembling *P. vaporarius* in some conditions" is entirely misleading. Compare *P. tomento-cincta* and *P. holoxantha*.

20. PORIA FATISCENS (Berk. & Rav.) Sacc. Syll. Fung. **6**: 331. 1888

Polyporus fatiscens Berk. & Rav.; Berk., Grevillea **1**: 65. 1872.

"Totus resupinatus albus tenuissimus pulveraceus; poris serius enatis primum punctiformibus dein angulatis. Car. Inf. Entirely resupinate. At first consisting of a thin white pulverulent stratum, which, after a time, bears pores about $1/100$ inch wide, which are at first punctiform, then angular."

Type from South Carolina, by Ravenel, on dead branches. See Rav. Fungi Car. Exsic. **2**: *21*. Although no mention is made of it in the description, herbarium specimens show the margin and very young tubes to be white and unchanging, while the older tubes exhibit various shades of yellow from sulphur-yellow to chrome-yellow. It would be interesting to know if this is true of fresh specimens.

21. PORIA FUSCO-MARGINATA Berk.; Cooke, Grevillea **15**: 24. 1886

"Orbicularis, elliptica vel confluens, adnata, ochraceo-pallida, margine tenui, membranaceo, sterili, fusco, poris minutis, rotundatis, aequalibus, centro tubulis elongatis, peripherico curtissimis, dein obsoletis, dissepimentis tenuibus."

Type from Rhode Island, on wood. Poorly preserved and scrappy at Kew, suggesting little.

22. PORIA RICHERIAE Pat. Bull. Soc. Myc. France **15**: 200. 1899

"Résupiné, inséparable du support, largement étalé, plan ou onduleux, dur et compact, crevassé par le sec, ayant à peine 1

millim. d'épaisseur, crême avec un reflet grisâtre ou violacé, entouré d'une marge stérile, très mince, lisse et d'un blanc de craie. Pores extrêmement petits (environ 60 μ de diamètre), superficiels, anguleux-sinueux, profunds de 40 à 50 μ. Trame blanchâtre, traversée dans toute son épaisseur par les cloisons qui sont très minces (30 à 50 μ) et entières."

Type from Guadeloupe, by Duss, on a trunk of *Richeria grandis*. Although I have visited Dr. Patouillard's private herbarium at Neuilly several times, I have no record of having examined this species.

23. Poria decolorans (Schw.) Sacc. Syll. Fung. **6**: 321. 1888

Polyporus decolorans Schw. Trans. Amer. Phil. Soc. **4**: 159. 1832.

"P. minutus, 3–4 lin. diametro, sed longe lateque confluens, non effusus, sed quasi totaliter affixus, margine inflexo libero, membranaceo. Primum mollusculus, albus, decolorans ac sordide brunneus devenit. Poris magnis subflexuosis, e forma orbiculari in flexuosam confluit. Tenerrimus."

Type from Bethlehem, Pennsylvania, by Schweinitz, on fallen bark. Seen at Philadelphia but not at Kew.

24. Poria clathrata (Berk. & Curt.) Sacc. Syll. Fung. **6**: 312. 1888

Polyporus clathratus Berk. & Curt.; Berk. Grevillea **1**: 54. 1872.

"Niveus, effusus, late cribrosus; parietibus cribrorum laccato-laevibus; poris punctiformibus, dissepimentis crassis obtusis. No. 3656. Louisiana. Dr. Hale. Widely effused, the hymenium with large apertures, the walls of which are smooth and honey colored. Pores 1/72 inch wide."

Type from Louisiana, by Dr. Hale, on trunks. Poorly preserved at Kew and seems abnormal, or at least peculiar. The "large apertures" are difficult to explain.

25. Poria cremor (Berk. & Curt.) Sacc. Syll. Fung. **6**: 297. 1888

Polyporus cremor Berk. & Curt. Hook. Jour. Bot. **1**: 104. 1849.

"Resupinatus, albus; margine obsoleto poris paris subrotundis, dissepimentis crassis, acie obtusissima.

"Resupinate, white, about an inch broad, consisting almost entirely of tubes. Margin obsolete. Pores small, round or slightly sinuated, their edge very obtuse.

"A distinct but not very remarkable species, allied most to *P. vulgaris,* but differing in its thick dissepiments and the obtuse edge of the pores."

Type from South Carolina, by Ravenel, on decayed oak branches and frequently on the disks whence twigs had been broken off. Seen at Kew and Upsala. The description was worked over for Grevillea **1**: 54. 1872, but too much stress was placed in both descriptions on the obtuseness of the dissepiments. It is quite distinct from *Poria dryina.*

26. PORIA RIVULOSA (Berk. & Curt.) Sacc. Syll. Fung. **6**: 293. 1888

Polyporus rivulosus Berk. & Curt. Jour. Linn. Soc. **10**: 318. 1868.

"Candidus, effusus, carnosus (siccus contractus rimulosus), margine tenui tomentoso; poris mediis rotundis, dissepimentis crassis pruinosis.

"On dead *Polypori.* Margin at length more or less free. Pores 1/60 inch in diameter."

Type from Cuba, by Wright, on dead polypores. Parts of the original may be seen at Kew and Paris.

27. PORIA ANAECTOPORA (Berk. & Curt.) Sacc. Syll. Fung. **6**: 326. 1888

Polyporus anaectoporus Berk. & Curt. Jour. Linn. Soc. **10**: 318. 1868.

"Totus resupinatus, margine tenuissimo; poris magnis hiantibus saepe decurrentibus (siccis rufis), dissepimentis rigidis subacutis.

"On dead bark. Pores 1/12–1/18 inch in diameter; their fructifying surface waxy."

Known only from specimens collected by Wright on dead bark in Cuba. Very peculiar, with large shallow tubes like those of *Favolus,* which become reddish when dry.

28. PORIA BARBAEFORMIS (Berk. & Curt.) Sacc. Syll. Fung. **6**: 316. 1888

Polyporus barbaeformis Berk. & Curt.; Berk. Grevillea **1**: 53. 1872.

"Totus resupinatus; margine tenui, albo; hymenio fulvo; poris parvis, elongatis, dissepimentis tenuibus. No. 4519. Alabama. Peters. On vine.

"Wholly resupinate with a thin white margin; hymenium tawny; pores 1/48 inch wide, but variable in size."

Type from Alabama, by Peters, on vine. Only small scraps of the original collection are to be seen at Kew. Specimens there from Pennsylvania and elsewhere do not agree with the type. Several fine specimens, true to type, were collected by Underwood on *Vitis* at Auburn, Alabama, in December, 1895, and January, 1896. These are now in the herbarium of the New York Botanical Garden. The tubes are milk-white on the edges and ochraceous-isabelline within.

29. PORIA VESICULOSA (Berk. & Curt.) Sacc. Syll. Fung. **6**: 332. 1888

Polyporus vesiculosus Berk. & Curt.; Berk. Grevillea **1**: 65. 1872.

Polyporus tenellus Berk. & Cooke; Cooke & Ellis, Grevillea **6**: 81. 1878.

Poria tenella Sacc. Syll. Fung. **6**: 331. 1888.

"Late effusus alutaceus; poris pezizaeformibus veluti è vesiculis ruptis enatis.

"Widely spreading, pale tan-colored; pores 1/100 inch wide, looking like minute burst bladders."

Described from specimens collected by Peters on pine planks in Alabama. Peck considered it in 1885 a variety of his quite variable *P. subacidus*. *Polyporus tenellus*, described from specimens collected by Ellis on pine boards at Newfield, New Jersey, doubtless represents only a younger stage of *P. vesiculosus* than that secured by Peters. It was originally described as follows:

"Totus resupinatus, albus, demum ochraceus, tenuissimus, pulveraceus; margine byssino, albo; poris angulatis, inaequalibus, brevibus, ad centro confertis.

"Allied to *P. fatiscens*, B. & R., very thin, with a broad white sterile byssoid margin."

30. **Poria subsulphurea** (Ellis & Ev.) comb. nov.

Myriadoporus subsulphureus Ellis & Ev. Bull. Torrey Club **24**: 277. 1897.

"Effused, immarginate, wood-color or grayish-white outside, light sulphur-yellow within, of a brittle corky texture, stratose, 4–5 mm. thick, extending continuously from 5–6 cm. or more; pores imperfectly developed, not continuous and cylindrical, but mere cavities scattered irregularly through the substance, more abundant near the surface.

"Has the general appearance of *Poria vulgaris* Fr. or *P. obducens* Pers."

Type from Denver, Colorado, by E. Bethel on dead coniferous wood. It is very pale yellow and the tubes are cellular and stratose. Abnormal forms like this species, *Poria indurata,* and *Poria vesiculosa,* etc., will have to be retained under their present names until more fully investigated. They may be only monstrous forms of well-known species or they may be distinct.

31. PORIA FAVESCENS (Schw.) Sacc. Syll. Fung. **6**: 325. 1888

Polyporus favescens Schw. Trans. Amer. Phil. Soc. **4**: 158. 1832.

"Non absimilis *P. megaloporo,* Pers. Myc. Eur. 105, differt colore. Bethlehem rarius in ramis. Favum refert.

"P. resupinato-effusus ad pedalem longitudinem, crassus, margine tenui subalbido, determinatim elevato ambitu. Poris latiusculis, hexagonis; tubis longissimis, pallidis."

Type from Bethlehem, Pennsylvania, by Schweinitz, on dead branches. To be seen both at Kew and Philadelphia. Compare carefully with *Poria Rhododendri* and *Coriolellus sepium,* from which it can hardly be distinct.

32. PORIA RHODODENDRI (Schw.) Sacc. Syll. Fung. **6**: 322. 1888

Polyporus Rhododendri Schw. Trans. Amer. Phil. Soc. **4**: 158. 1832.

"P. longitudinaliter effusus, angustatus. Primum observatur membrana papyracea, detractabilis, albescens aut pallescens, in cujus centro *pori* pauci parum elevati, lati, occurrunt. Demum

poris his, tota superficie obsita est, membrana, tantum non in ambitu ubi sublibera et subinflexa. Poris tandem in tubos angulatos, margine fimbriatos, 2–3 lineas altos, ex pallide fuscescentes, elevatis. Totus fungus 1–3 uncias longus, ¼ unc. latus, affinis *P. contiguo.*"

Type from Bethlehem, Pennsylvania, by Schweinitz, on fallen trunks of *Rhododendron maximum.* Compare carefully with *Poria favescens* and *Coriolellus sepium.*

33. PORIA HYPERBOREA Berk.; Cooke, Grevillea 15: 27. 1886

"This also is a very doubtful species, not apparently described. There is but a single specimen, which apparently is the resupinate condition of *Polystictus,* and probably *P. hirsutus* or *P. velutinus.*"

Type from British North America, by Dr. Richardson, on trunks. Cooke was perfectly correct in saying that this is merely a resupinate condition of some species of *Coriolus.* Berkeley left a number of manuscript species in the herbarium at Kew, many of them worthless, which were no doubt held back purposely. One should be extremely careful about publishing herbarium names unless he can secure permission from the author; for in striving to give credit, he may bring discredit.

34. PORIA FAVILLACEA (Berk. & Curt.) Sacc. Syll. Fung. **6**: 305. 1888

Polyporus favillaceus Berk. & Curt.; Berk. Grevillea **1**: 53. 1872.

"Brevis, sparsus; margine liberato, tomentoso; hymenio cinereo; poris minimis. No. 5266. New Eng., Sprague. Consisting of little scattered patches; margin at length free and tomentose; hymenium ash-colored; pores 1/150 inch wide. Parasitic, together with a minute Hydnum, on some indeterminable resupinate Polyporus."

Type from New England, by Sprague, on trunks. Seen at Kew. The little patches somewhat resemble *Aleurodiscus Oakesii,* while the tubes are much smaller than those of *Coriolus abietinus.*

35. PORIA LINDBLADII (Berk.) Sacc. Syll. Fung. 6: 306. 1888

Polyporus Lindbladii Berk. Grevillea 1: 54. 1872.

"Pileo resupinato, rigido; margine tomentoso albo demum libero; hymenio griseo, fuscescente; poris angulatis. No. 1623. Car. Inf. Spreading for some inches; of a peculiar grey tint. Pores 1/60 inch wide. The Carolina specimens are a little darker than those originally received from Sweden."

Described from specimens collected in South Carolina, by Ravenel, on trunks. Seen at Kew, Paris, and Upsala. It is only a resupinate form of *Polyporus floridanus* Berk., which is a small-pored variety of *Coriolus sector*.

NEW YORK BOTANICAL GARDEN.

SOME COLORADO FUNGI*

L. O. Overholts

Except for a considerable number of papers on parasitic fungi, very little literature dealing with the fungous flora of the western states has yet appeared. As a matter of fact a prodigious amount of work is necessary before the fungi of any large section of the United States can be accurately catalogued. As a means to this end carefully prepared check lists are invaluable, provided the specimens and notes on which they are based are adequately preserved. Such lists are also of some value to local collectors, both in aiding them in their determinations and in stimulating more widespread interest in collecting and preserving the specimens.

The writer spent parts of the summers of 1913 and 1914 at the Mountain Laboratory of the University of Colorado for the purpose of collecting the fleshy and woody fungi of that region. Through the efforts of Dr. Francis Ramaley, Professor of Botany in the University of Colorado, a certain amount of financial assistance was obtained from that institution in return for a duplicate set of the specimens collected. These are, therefore, deposited in the herbarium of that University. The most complete set of specimens is retained in the writer's herbarium. Duplicates of some of the collections are in the herbarium of the Missouri Botanical Garden and the New York Botanical Garden.

The Mountain Laboratory of the University of Colorado is located in the town of Tolland, in Gilpin County, Colorado. This town lies on the Moffatt Railroad 47 miles northwest of Denver, and on South Boulder Creek. South Boulder Park, in which the town lies, has become well known to botanists through the writings of Dr. Ramaley, Professor W. W. Robbins, and others interested in the ecology of the eastern slopes of the Rocky Mountains. It lies at an elevation of practically 9,000 feet

* Contribution from the Department of Botany, The Pennsylvania State College, No. 18.

above sea level. The park itself is a dry grass land area about 2 miles long and half a mile wide, through which flows South Boulder Creek. Dense willow growths border parts of this stream and the soil beneath supports in proper season a considerable fungous flora. The grass land is too dry for all except those fungi of decided xerophytic habits, among the most important of which are puffballs, the fairy ring *Tricholoma* (*T. premagna*), and *Agaricus campestris*. The best collecting is to be found in the coniferous forests bordering the various streams that enter the park from the surrounding gulches and cañons. Of these the best in this locality are South Boulder Cañon and Jennie Creek. The latter is not much above the level of the park floor in elevation, but the former is a deep though fairly broad cañon extending from the west end of the park up to the continental divide, a distance of about 4 miles and with an elevation of from 9,000 to more than 10,000 feet. The tree growth in this cañon (as well as bordering all other streams) is largely of coniferous species, mostly *Picea engelmannii*. On the drier mountain slopes the lodge-pole pine predominates, and aspen thickets are not infrequent in moist situations.

Owing to the high elevation of this region spring is late in arriving and in both 1913 and 1914 snow drifts remained in the surrounding forests until nearly July 1, and at higher elevations much later. Both seasons the rainfall was light until about the middle or latter half of July, although light showers are of frequent (sometimes almost daily) occurrence. In July, however, heavy rains occurred and it was following these that fungi were found in greatest abundance. Apparently the fungous flora is not an unusually rich one, partially because of the short growing season. A total of nearly 1,000 collections were made in the two seasons but in neither instance did the collecting cover the entire season.

A considerable amount of information was collected as to the altitudinal distribution, seasonal appearance, and other ecological data pertaining to the fleshy fungi, but its publication is withheld for the present with the hope of adding to it in the near future. However, there appears to be almost as decided a suc-

cession of fungous genera and species throughout the season as is the case in flowering plants. The fact that with the rapid disappearance of the snow in June the earth warms up more rapidly than in places at lower elevations, makes this type of locality unusually favorable for studying this succession of forms.

In 1914 two days were spent in collecting in the vicinity of Denver and Golden in company with Professor E. Bethel, and those collections are included in this report. Professor Bethel has also sent in at various times specimens collected in different localities. Dr. Ramaley has supplied a small collection of specimens from Boulder and Tolland. But by far the larger part of the numbers here reported are from the vicinity of Tolland and collected by the writer.

Unfortunately the literature on American gill fungi is yet so fragmentary that it has been impossible to identify a large percentage of the collections in that family. Undoubtedly a considerable number of these are new to science but none such are described at this time.

The entire number of species listed in this report is 152. If all the collections obtained were determined the list would be at least twice as large. Even that number would represent only a fraction of the entire number of species to be found in this locality if the collecting could be extended over several entire seasons.

The writer desires to acknowledge his obligations to the University of Colorado and especially to Dr. Ramaley for furthering this work in all possible ways, and to other members of the laboratory staff and the various students whose interest in the work was decidedly helpful. In certain groups of these fungi the determinations have been made by specialists and such determinations have added considerably to the completeness and the accuracy of this list. Due credit is given throughout the list for determinations so made.

ASCOMYCETES[1]

[1] All determinations of Ascomycetes were either made or verified by Dr. F. J. Seaver.

1. ORDER SPHAERIALES

1. *Diatrypella verruciformis* (Ehrh.) Nito. On Alnus. Golden. Alt. 7000 ft. June 14, 1914. No. 1767.

2. Order Pezizales

2. *Discina ancilis* (Pers.) Sacc. On wet ground in coniferous forests. Jennie Creek and South Boulder Cañon. Alt. 9,000–10,500 ft. June 16, 19, 21, 30, 1914. Nos. 1739, 1805, 1810, 1841. Also collected by Dr. Ramaley at Tolland in 1912.

   Mature specimens bear considerable resemblance to *Gyromitra.* It is one of the earliest forms to appear in the springtime, following immediately after the disappearing snowdrifts.

3. *Geopyxis cupularis* (L.) Sacc. On ground where fires have been kindled. South Boulder Cañon. Alt. 9,000 ft. June 19, July 8, 22, 1914. Nos. 1796, 1879, 1968.

   A beautiful species, yellowish or brownish, more or less urn-shaped and about 1 cm. high.

4. *Pseudoplectania fulgens* (Pers.) Fuckel. On ground in coniferous forests. South Boulder Cañon. June 30, 1914. No. 1839.
5. *Sepultaria arenicola* (Lév.) Boud. On ground in aspen thicket. South Boulder Cañon. July 29, 1913. No. 2035.
6. *Cenangium populneum* (Pers.) Rehm. On dead limbs of *Populus.* Golden. Alt. 7,000 ft. June 14, 1914. No. 1755. The collection was made in company with E. Bethel.

3. Order Helvellales

7. *Gyromitra esculenta* (Pers.) Fr. On ground in coniferous forests. Ladora. Alt. 9,000 ft. June 21, 1914. No. 1806.
8. *Gyromitra gigas* (*Krombh.*) *Cooke.* On ground in coniferous forests. South Boulder Cañon. Alt. 10,000 ft. June 25, 30, 1914. Nos. 1829, 1837.
9. *Helvella infula* Schaeff. On ground in coniferous forest. Tolland, June 20, 1914. No. 1804.
10. *Helvella lacunosa* Afzel.? On ground in marshy aspen thicket. Tolland. July 14, 1913. No. 2008.
11. *Morchella conica* Pers. On ground. Tolland. July 24, 1913. No. 2028. Also collected by Dr. Ramaley in Jenny Lind Gulch, July, 1912.

BASIDIOMYCETES

Hemi-Basidiomycetes

1. Order Uredinales[2]

12. *Gymnosporangium clavariaeforme* (Jacq.) DC. On stems of *Juniperus sibirica.* Tolland. June 16, 1914. No. 1740. Very common on this host.
13. *Melampsora arctica* Rostr. On leaves of *Salix* sp. Tolland. July 16. No. 2563.
14. *Melampsora pyrolae* (DC.) Arthur. On leaves of *Pyrola.* Tolland and Golden. July 1, 1913; June 14, 1914. No. 1746, 2405.

[2] Dr. J. C. Arthur has determined all the rusts with the exception of Nos. 12 and 15, the former of which was determined by Dr. F. D. Kern, and the latter by Prof. C. R. Orton.

15. *Peridermium harknessii* American authors. (Not *P. harknesii* Moore.) Forming galls on *Pinus contorta*. Lake Eldora and Tolland. June 27, 1913, collected by W. W. Robbins. June, 1914, collected by E. Bethel. Nos. 2309, 2831.

The alternate hosts of this rust are species of *Castilleja* and *Orthocarpus*.

16. *Phragmidium montivagum* Arth. On leaves of wild rose. Golden. June 14, 1914. No. 1749.

17. *Puccinia agropyri* Ellis & Ev. On leaves of *Thalictrum*. Tolland. July 19, 1913. No. 3565.

18. *Puccinia fergussoni* B. & R. On leaves of *Viola*. Tolland. July 14. 1913. No. 2010.

19. *Puccinia taraxaci* Plowr. On leaves of *Taraxacum officinale*. June 22, 1914. No. 2564.

EU-BASIDIOMYCETES

1. FAMILY AURICULARIACEAE

20. *Auricularia auricula-judae* L. On pine logs. Tolland. July 16, 1913. No. 2014. Common after the July rains. Edible and quite delicious.

2. FAMILY TREMELLACEAE

21. *Exidia glandulosa* (Bull.) Fr. On dead alder and willow. Golden and Tolland. Alt. 7,000–9,000 ft. July 16, 1913; June 14, 1914. Nos. 1757, 2017.

3. FAMILY DACRYOMYCETACEAE

22. *Guepinia monticola* Tracy & Earle. This species was determined by C. G. Lloyd, but the collection has recently been mislaid and the data concerning it is therefore not available. It was collected at Tolland, on fallen coniferous wood, and has more the appearance of a Discomycete than a Basidiomycete. No. 1737.

4. FAMILY THELEPHORACEAE

23. *Corticium corruge* Burt. On dead pine limbs. Tolland and Glacier Lake (Prof. Bethel). Alt. 9,000–10,000 ft. June 16, 20, 1914. Common on pine slash on the ground. Nos. 1741, 1801, 1803, 2386.

24. *Corticium galactinum* (Fr.) Burt. On old coniferous log. Golden. Alt. 7,000 ft. June 14, 1914. No. 1745.

25. *Peniophora cinerea* Fr. On dead *Alnus*. Golden. June 14, 1914. Nos. 1744, 1769.

26. *Stereum* ————. On coniferous logs. Tolland. June 29, 1913; June 17, 1914. Nos. 1781, 2336. A species quite similar to *Stereum bicolor*, but distinct.

27. *Stereum fasciatum* Schw. On dead *Alnus*. Golden. June 14, 1914. No. 1758.

28. *Stereum rameale* Schw. On dead *Alnus*. Tolland. June 30, 1913. No. 2000. Both this and the preceding species are rare in this locality as contrasted with their abundant occurrence in most eastern states.

29. *Stereum rufum* Fr. On dead limbs of *Populus*. Golden and Tolland. Alt. 7,000–9,000 ft. June 14, July 5, 1914. No. 1761. For an account of this species see von Schrenk, H., Bul. Torr. Club 21: 385–388. 1894.
30. *Thelephora caryophyllea* (Schaeff.) Fr. On ground in forests and on mountain slopes. Tolland. June 25, 1913; Aug. 3, 1914. Nos. 2208, 2082.
31. *Thelephora palmata* (Scop.) Fr. On Ground in forests. Boulder. June 21, 1914. No. 2385. Collected by E. Bethel. This species is usually easily recognized by the foetid odor of fresh specimens. The odor of this collection still persists after nearly five years in the herbarium.

5. FAMILY CLAVARIACEAE

32. *Clavaria inaequalis* Lasch. On ground among pine needles. Tolland. July 25, 1914. No. 1979.

    Common after the July rains. Gregarious and easily obtained in abundance.

6. FAMILY HYDNACEAE

33. *Hydnum imbricatum* (Pers.) Fr. On stream bank in coniferous forest. Tolland. July 28, 1913. No. 2029.

7. FAMILY AGARICACEAE

34. *Agaricus campestris* (L.) Fr. On the ground in dry grassland. Tolland. Alt. 9,000 ft. June 4, 1914. No. 2112. Not abundant but fairly common after the July rains.
35. *Agaricus silvicola* (Vitt.) Fr. On the ground in woods or along their borders. Tolland. Alt. 9,000 ft. June 20, 22, 23, 1914. Nos. 1952, 1966, 2423.
36. *Agaricus villaticus* Brond. On manure heap. Tolland (Golden Sun Mine). Alt. 8,700 ft. June 22, 1914. No. 1811.

    This collection is so referred on the basis of the striking resemblance to Cooke's illustrations, pl. 584. It may be only an overgrown form of *A. campestris*. The pileus of the largest specimen was 18 cm. broad, somewhat scaly, avellaneous or wood brown, taste amygdaline.
37. *Amanita muscaria* (L.) Fr. On ground in woods along stream. Tolland. Alt. 9,000 ft. July 27, 1914. No. 1985. But one specimen of this species was collected.
38. *Amanita phalloides* Fr. On the ground in pine woods. Tolland. Alt. 9,000 ft. July 5, 1914. No. 2113. The specimens are not typical and may have to be referred to another species.
39. *Amanitopsis vaginata* (Bull.) Roze. On the ground, especially in aspen thickets. Boulder. July 15, 1914. E. Bethel. Tolland. Alt. 9,000 ft. June 23, July 12, 19, 21, 22, 25, August 3. Nos. 1342, 1929, 1971, 1974, 1975, 2090, 2845, 2852, 2850. Also collected by Dr. Ramaley at Boulder, July 16, 1913.
40. *Anellaria separata* (L.) P. Karst. On manure heaps. Rollinsville. Alt. 8,700 ft. June 22. Tolland, Alt. 9,000 ft. June 23, 25, 1913. Nos. 1242, 1246, 1813.
41. *Bolbitius fragilis* Fr. On the ground among grass. Mammoth Creek. Alt. 9,500 ft. July 18, 1914. No. 1928.

42. *Cantharellus cibarius* Fr. On the ground under lodge-pole pines. Tolland. Alt. 9,000 ft. July 29, 1914. No. 2060.
43. *Cantharellus muscigenus* (Bull.) Fr. On the ground among mosses under conifers. Tolland. Alt. 9,000 ft. June 26, 1913. No. 1263.

    An interesting plant, consisting of a short lateral stem, a pileus less than 1 cm. broad, and bearing branched ribs on the lower side.
44. *Clitocybe coloradensis* Murrill. On moist grassy ground under willows. Tolland. July 22, 1913; July 11, 21, 1914. Nos. 1354, 1890, 1953.

    No. 1890 is designated as the type of this species by Murrill.
45. *Clitocybe infundibuliformis* (Schaeff.) Fr. On the ground in grassland. Tolland. Alt. 9,000 ft. July 14, 1914. No. 1914.

    The small size, infundifuliform pileus, and pinkish-cinnamon color are the chief characteristics.
46. *Clitocybe inversa* (Scop.) Fr. On compost and forest litter. South Boulder Cañon. Alt. 9,000 ft. July 21, 1913; July 8, 22, August 5, 1914. Nos. 1333, 1884, 1961, 2122.

    The pileus is pinkish-cinnamon or apricot buff in color, and 5–10 cm. broad. The spores are subglobose, slightly echinulate, 3.5–5 μ. I am indebted to Dr. Murrill for the determination.
47. *Clitocybe laccata* (Scop.) Fr. On the ground, usually along streams. Tolland. Alt. 9,600 ft. June 26, 1913; July 5, 7, 12, 17, 20, 30. Nos. 1258, 1405, 1858, 1870, 1894, 1921, 1945.
48. *Clitocybe maxima* (Gart. & Meyer) Fr. On the ground, especially on moist cleared mountain sides. South Boulder Cañon. Alt. 9,500–10,000 ft. July 22, 29, 1913. Nos. 1347, 1400.

    A very large plant (up to 25 cm. broad) with thin depressed pileus, white in color. Clement's illustration (Minnesota Mushrooms, f. 12) shows the plant well.
49. *Clitocybe multiceps* Peck. On the ground. Boulder. Alt. 7,000 ft. June 22, 1914. No. 1821. Collected by E. Bethel.

    The cespitose habit, large size, and the globose spores are the distinguishing characters.
50. *Clitocybe overholtsii* Murrill. On ground in coniferous forests. Tolland and South Boulder Cañon. July 22, 29, Aug. 1, 5, 1914. Nos. 1964, 2114. No. 2114 was designated by Murrill as the type collection of this species.
51. *Clitocybe tortilis* Fr. On ground. Boulder. Aug. 2, 1914. No. 2843. Collected by E. Bethel.
52. *Clitocybe vilescens* Peck? On the ground in grassland. Tolland. Alt. 9,000 ft. June 24, Aug. 4, 1914. Nos. 1820, 2111.

    The small size (1–3 cm.), the dull cinereous color, the farinaceous taste, and the habitat appear to be the distinctive characters.
53. *Collybia acervata* Fr. On rotten wood. Tolland and Gilpin Saw Mill. Alt. 9,000–10,000 ft. July 29, August 2, 1913; July 27, 1914. Nos. 1391, 1996.
54. *Collybia amabilipes* Peck. On stumps or attached to buried wood. Tolland and South Boulder Cañon. Alt. 9,000–9,500 ft. July 3, 1913; July 8, 1914. Nos. 1278, 1888. *Collybia tenuipes* Schw. is said to be the same plant. As has been previously pointed out, the resemblance

of this plant to *C. velutipes* is close, and dried specimens of the two species are sometimes hard to distinguish.

55. *Collybia maculata* Alb. & Schw. On humus. Tolland. Alt. 9,000 ft. July 27, 1914. No. 1991.

56. *Coprinus atramentarius* (Bull.) Fr. On ground around stump. Tolland. Alt. 9,000 ft. July 3, 1914. No. 1277.

57. *Coprinus micaceus* (Bull.) Fr. On ground. Boulder. Alt. 7,000 ft. June 23, 1914. Collected by E. Bethel. No. 2848. Also collected by Dr. Ramaley at Tolland. June 26, 1911.

A third species of *Coprinus* was collected rather abundantly at Denver by Prof. Bethel, on stems of *Agropyron,* in June, 1914. The identity of the species has not been established.

58. *Cortinarius*[3] *argentatus* Fr.? On ground in coniferous forests. South Boulder Cañon. Alt. 9,000 ft. July 8, 1914. No. 1885.

59. *Cortinarius cinnamomeus* Fr. On ground in coniferous forests, aspen thickets, and under willows. Tolland. Alt. 9,000 ft. July 18, 1913; July 14, 1914. Nos. 1324, 1911, 1912.

An abundant species, and edible.

60. *Cortinarius concinnus* P. Karst. On grassy ground among willows. Boulder Park. Alt. 9,000 ft. July 14, 22, 1914. Nos. 1913, 1965.

Abundant in 1914. Characterized by the color, which is brick-red, ferruginous, or almost blood-red.

61. *Cortinarius corrosus* Fr.? On the ground in coniferous forests. Jennie Creek. Alt. 9,000 ft. July 20, 27, 1914. Nos. 1943, 1998.

62. *Cortinarius decoloratus* Fr. On the ground in coniferous forests. Tolland. Alt. 9,000 ft. July 28, 1913. No. 1377.

63. *Cortinarius glandicolor* Fr. On the ground in coniferous forest. Jennie Creek. Alt. 9,000 ft. July 27, 1914. No. 1990.

64. *Cortinarius herepeticus* Fr.? On the ground in coniferous forests. Tolland. Alt. 9,000 ft. July 28, 1913. No. 1378.

65. *Cortinarius malicorius* Fr. On the ground in coniferous forests. Jennie Creek. Alt. 9,000 ft. June 17, 1914. No. 1764.

66. *Cortinarius mucifluus* Fr. On the ground in aspen thickets. Tolland. Alt. 9,000 ft. July 25, August 3, 1914. Nos. 1982, 2096.

67. *Cortinarius psammocephalus* Fr. On the ground under pines. Tolland. Alt. 9,000 ft. Aug. 3, 1914. No. 2092.

68. *Cortinarius rusticus* P. Karst. On the ground in coniferous forest. Jennie Creek. Alt. 9,000 ft. July 20, 1914. No. 1951.

In point of numbers this seems to be the largest genus in the Colorado fungous flora. In addition to the collections cited above there are about 25 collections of unidentified material in the writer's herbarium.

69. *Flammula penetrans* Fr. On rotten coniferous wood in pine woods. Tolland. Alt. 9,000 ft. July 29, 1914. No. 2070.

70. *Flammula spumosa* Fr. Usually on buried wood, especially in old corduroy roads. Also on logs. Golden, South Boulder Cañon, Tolland. Alt. 7,000–10,000 ft. June 15, 19, 21, 28, 1913; June 14, 25, July 2, 5,

[3] All determinations in this genus were made by Dr. C. H. Kauffman.

7, 12, 1914. Nos. 1299, 1330, 1339, 1372, 1747, 1825, 1848, 1857, 1867, 1892.

Very abundant, especially after July rains. Edible.

71. *Hebeloma album* Peck. On ground in aspen thicket. Tolland. July 29, 1913. No. 1402.

This collection agrees well with the type specimens at Albany.

72. *Hebeloma crustuliniforme* (Bull.) Fr. On ground in aspen thicket. Tolland. Aug. 3, 1914. No. 2091.

73. *Hygrophorus conicus* (Scop.) Fr. On ground on rocky grassy slopes after heavy rains. Tolland. June 26, 27, 1913; July 13, 24, 1914. Nos. 1264, 1265, 1362, 1900.

Easily recognized by the bright-red conical pileus that in drying generally becomes blackish.

74. *Hypholoma incertum* Peck. On grassy ground. Boulder and Denver. May, July, 1914. Collected by E. Bethel. Nos. 1772, 2838. Also collected by Dr. Ramaley at Boulder, July 20, 1913.

75. *Hypholoma fasiculare* Huds. Attached to buried wood, on stumps, or apparently on the ground. South Boulder Cañon. Alt. 9,000–9,500 ft. July 29, 1913; July 12, 1914. Nos. 1397, 1895.

76. *Lactarius*[4] *alpinus* Peck. On ground in aspen thickets. Tolland. Aug. 1, 1913. No. 1413.

77. *Lactarius aspidioides* Burlingh. On ground under willows. Tolland. July 22, 1914. No. 1955.

78. *Lactarius cilicioides* Fr. On ground in aspen thickets and under pines. Tolland. Alt. 9,000–9,500 ft. July 29, 1913; July 29, 1914. Nos. 1392, 2081. Dr. Ramaley also collected it in South Boulder Cañon, August 31, 1912.

79. *Lactarius deliciosus* (L.) Fr. On ground in coniferous forests, especially on sandy slopes. Tolland and South Boulder Cañon. July 15, 1913; July 17, 29, August 5, 1914. Nos. 1913, 1927, 2062, 2123.

80. *Lactarius helvus* Fr. On ground in coniferous forests. Tolland. July 28, 1913. No. 1380.

81. *Lactarius lividorubescens* (Batsch.) Burlingh. On ground in aspen thickets. Tolland. Aug. 3, 1914. No. 2085.

82. *Lactarius parvus* Peck. On mossy bank by stream. Tolland. July 5, 1913. No. 1284.

83. *Lactarius subdulcis* Bull. On the ground in coniferous forests. Tolland. July 16, 30, 1913. Nos. 666, 1309.

84. *Lentinus lepideus* Fr. On railroad ties, coniferous logs and stumps, bridge timbers etc. Tolland and South Boulder Cañon. June 27, July 4, 13, 22, 31, 1913; June 2, 25, July 8, 12, 16, 1914. Nos. 665, 667, 1270, 1279, 1292, 1349, 1819, 1826, 1897, 1916.

85. *Lepiota granulosa* (Batsch) Gray. On ground in coniferous forests, especially in clearings. Tolland and South Boulder Cañon. July 30, 1913; July 21, 22, Aug. 5, 1914. Nos. 1337, 1406, 1906, 2115.

86. *Lepiota naucina* Fr. In dry grassland. Tolland. Aug. 4, 1914. No. 2108.

[4] All determinations in this genus were either made or verified by Miss G. S. Burlingham.

87. *Marasmius androsaceus* (L.) Fr. Among needles of lodge-pole pines. Tolland. July 16, 1913; July 20, 1914. Nos. 1305, 1936.

88. *Marasmius rotula* (Scop.) Fr. On rotten wood. Boulder. Aug. 2, 1914. Collected by E. Bethel. No. 2836.

89. *Marasmius semihirtipes* Peck. Among pine needles in coniferous forests. Tolland. July 16, 24, 1903; July 20, 1914. Nos. 1304, 1355, 1937.

90. *Mycena pura* (Pers.) Fr. On ground in coniferous forests. Tolland and South Boulder Cañon. July 20, 22, 1914. Nos. 1935, 1962.

91. *Omphalia campanella* (Batsch) Fr. On rotten logs of conifers. Golden, Tolland, and South Boulder Cañon. Alt. 7,000 to 9,500 ft. June 14, 17, 19, July 22, 1914. Nos. 1751, 1777, 1790, 1963.

92. *Pholiota acericola* Peck. On old logs and on the ground. Tolland. July 7, 1914. No. 1866.

93. *Pholiota howeana* Peck. On ground in dry coniferous forest. Tolland. June 26, 1913. No. 1256.

94. *Pholiota marginella* Peck. On dead coniferous timbers and on sawdust heaps. Tolland, South Boulder Cañon, and Gilpin sawmill; altitude 9,000 to 10,000 ft. June 26, July 1, 8, 1913; June 17, 18, 30, July 2, 1914. Nos. 1261, 1274, 1765, 1778, 1779, 1784, 1831, 1847.

I have referred here the common small yellowish-brown *Pholiota* so abundant on old coniferous logs in that region. It differs from *P. marginata* in having smaller, smooth, thin-walled spores and lacking cystidia. The spores of the latter species are much darker due to the heavy wall that is slightly roughened. *P. unicolor* is a related species with hymenial characters as in *P. marginata* but with a well developed persistent annulus. The spores of *P. marginella* measure 6–9 × 3.5–5 μ. Those of the other two species measure 8–10 × 5 μ.

95. *Pholiota praecox* (Pers.) Fr. On the ground in grassy places and in open coniferous forests. Tolland, South Boulder Cañon, and Lake Eldora. June 25, 26, July 4, 18, 21, 1913; June 25, July 19, 1914. Nos. 1253, 1267, 1316, 1343, 1797, 1824, 2308, 2329.

96. *Pholiota vermiflua* Peck. In grassy ground. Denver. May, 1914. Nos. 1771, 1773. Collected by E. Bethel.

97. *Pleurotus ostreatus* Jacq. On dead wood. Tolland. June 27, 1913; July 29, 1914. Nos. 1269, 2064.

98. *Pluteus cervinus* (Schaeff.) Fr. On ground rich in humus. June 27, 1913; July 12, 1914. Nos. 1260, 1893.

99. *Russula*[5] *abietina* Peck. On moist ground in coniferous forests. Tolland and South Boulder Cañon. July 16, 30, 1913. Aug. 5, 1914. Nos. 1306, 1403, 2117.

100. *Russula alutacea* Fr. On ground in coniferous forests. Tolland and South Boulder Cañon. July 24, 1913; Aug. 3, 4, 5, 1914. Nos. 1359, 2097, 2105, 2106, 2116, 2124.

101. *Russula atroviolacea* Burlingh. On ground under willows. Tolland. July 14, 1914. No. 1909. This collection was made the type of a new species by Miss Burlingham.

102. *Russula betulina* Burlingh. On ground in aspen thickets or under pines. Tolland, July 25, Aug. 3, 1914. Nos. 1978, 2084, 2094.

[5] All determinations in this genus were made by Miss G. S. Burlingham.

103. *Russula chamaeleontina* Fr. On ground in coniferous forest. Tolland. July 18, 1913. No. 1315.

104. *Russula consobrina* Fr. On ground in coniferous forests. Tolland. July 28, 1913. No. 1386.

105. *Russula emetica* Fr. On ground in coniferous forests. South Boulder Cañon. Aug. 2, 1913. No. 1423.

106. *Russula fallax* Fr. On ground under willows. Tolland. July 8, 1914. No. 1883.

107. *Russula flava* Romell. On ground in aspen thicket. Tolland. July 24, 1913. No. 1365.

108. *Russula nigrodisca* Peck. On mossy decayed logs in aspen thickets. Tolland. Aug. 1, 1913; July 25, 1914. Nos. 1411, 1983. The type collection of this species was collected on St. Paul Island, Behring Sea, and otherwise the species is only known from Colorado and Vermont.

109. *Russula subolivascens* Burlingh. On ground in aspen thicket. Tolland. Aug. 3, 1914. Nos. 2083, 2089.

110. *Russula raoultii* Quél. On ground in mixed forest. Tolland. July 27, 1914. No. 1988.

111. *Russula squalida* Peck. On ground in aspen thicket. Tolland. Aug. 3, 1914. No. 2088.

112. *Russula subalutacea* Burlingh. On ground in mixed forest or under pines. Tolland. July 24, 1913; July 27, Aug. 3, 4, 1914. Nos. 1363, 1987, 2093, 2104.

No. 2093 has been made the type collection for this species by Miss Burlingham.

113. *Russula turci* Bres. On ground in coniferous forest. Tolland. July 28, 1913. No. 1389.

114. *Russula xerampelina* Fr. On ground at edge of pine forest. Tolland. July 24, 1913. No. 1364.

115. *Panaeolus retirugis* Fr. On ground in path. Tolland. July 4, 1914. Collected by Miss Helen Leonard. No. 1854.

116. *Stropharia semiglobata* (Batsch.) Fr. On horse dung. Tolland. July 12, 19, 1914. No. 1899, 1930.

117. *Tricholoma praemagna* Murrill. On ground in dry grassland. Tolland. June 27, 1913; July 22, Aug. 5, 1914; May, 1917. Nos. 1268, 1972, 2121, 3908.

This is the fungus that causes the formation of the conspicuous fairy rings in open grasslands of this region. For an account of these see Ramaley, F., Torreya 16: 193–196. 1916. The fungus is used as an article of food in this locality.

8. FAMILY BOLETACEAE

118. *Boletinus pictus* Peck. On ground in pine woods. Tolland. Alt. 9,000 ft. July 27, 1914. No. 1999.

119. *Boletus brevipes* Peck. On ground in coniferous forests. Especially on sandy ground. Under lodge-pole pines. Tolland. Alt. 9,000 ft. June 26, 1913; June 12, July 2, 29, 1914. Nos. 1815, 1851, 2063, 2312.

Dr. Murrill refers this species to *B. granulatus* but his description of that species does not fit these collections as well as does Peck's description of *B. brevipes*.

120. *Boletus edulis* (Bull.) Fr. On the ground in coniferous forests. Tolland. Alt. 9,000 ft. July 17, August 4, 1914. Nos. 1926, 2107.

121. *Boletus granulatus* (L.) Fr. On the ground in coniferous forests. Tolland. Alt. 9,000 ft. June 25, 1913; July 20, 1914. Nos. 1940, 2328.

122. *Boletus hirtellus* Peck. On the ground in the upland lodge-pole pine forests. Tolland. Alt. 9,000 ft. Aug. 6, 1914. No. 2057.

This species is a very beautiful one with a lemon yellow pileus thickly adorned with small tufts of hair. It is quite abundant after the July rains.

123. *Boletus scaber* Fr. On ground, usually in aspen thickets. Rollinsville, Tolland and South Boulder Cañon. June, July, and August. Nos. 1812, 1856, 1917, 1827, 1859, 2424, 2038.

The species is very abundant, and of all the collections made only one was from the coniferous forest floor. Its usual habitat is grassy aspen thickets. The pileus of one specimen measured 26 cm. in diameter. The color is very variable, from white to tan, brown, or red. Edible.

9. Family Polyporaceae

124. *Favolus canadensis* Klotzsch. Boulder. Alt. 7,000 ft. On dead chokecherry. July 1, 1914. Collected by E. Bethel. No. 2832.

125. *Fomes fulvus* (Scop.) Gill. On *Prunus americana*. Boulder. Alt. 7,000 ft. June 24, 1914. Collected by E. Bethel. No. 2833.

126. *Fomes pini* (Thore) Lloyd. On coniferous trees and logs. Tolland, South Boulder Cañon and Lake Eldora. Alt. 9,000–9,500 ft. June 30, July 7, 1913; June 29, July 3, 4, 19, 28, 1914. Nos. 632, 642, 1844, 1877, 2018, 2033, 2391.

127. *Fomes pinicola* (Sw.) Cooke. On coniferous trees and logs. Tolland and South Boulder Cañon. Alt. 9,000–10,000 ft. June 23, 29, July 1, 1913; July 7, 1914. Nos. 645, 1875, 2005, 2402.

128. *Lenzites saepiaria* (L.) Fr. On coniferous logs. Tolland. June 29, 1913; July 7, 1914. Nos. 1878, 2313.

129. *Polyporus abietinus* (Dicks.) Fr. On coniferous logs. Tolland. June 30, July 8, 1913. Nos. 2001, 2007.

The former collection is of the sub-lamellate type of the plant, which is common in the east but more rarely found in the west.

130. *Polyporus adustus* (Willd.) Fr. On stump of *Pinus*. Tolland. June 17, 1914. No. 1780. An unusual host for this species.

131. *Polyporus alboluteus* Ellis & Ev. On coniferous logs mostly at high elevations (9,000 to 10,000 ft.). Tolland and South Boulder Cañon up to timber line. June 29, July 1, 1913; June 21, 25, 30, 1914. Nos. 629, 641, 1807, 1830, 1832.

A common orange red species often more or less resupinate.

132. *Polyporus confluens* Fr. (?). Collected by Dr. Ramaley at Boulder, Aug. 30, 1913.

This species is incorporated with some misgiving. The collection

consists of 8 or 10 plants preserved in formaldehyde. Undoubtedly most of the original color is lost, but there is a decided red or yellowish red tint to stems and tubes of some specimens.

133. *Polyporus elegans* (Bull.) Fr. On rotten wood. Tolland. July 24, 1913. No. 2027.

134. *Polyporus leucospongia* Cooke & Harkness. On coniferous logs at elevations of 9,000 to 11,000 ft. Tolland and South Boulder Cañon up to timber line. June 29, July 13, 1913; June 25, 29, 30, July 2, 1914. Nos. 643, 644, 1828, 1840, 2353, 2388.

A soft, pure white, sessile species. Rather abundant.

135. *Polyporus pargamenus* Fr. On dead *Populus*. Golden. June 14, 1914. No. 1756.

This collection represents the thick form of the species, more or less characteristic of the plant when growing on this host, and described by Murrill as *P. subchartaceus*.

136. *Polyporus perennis* (L.) Fr. On ground under pines. Tolland. Aug. 3, 1914. No. 2099.

137. *Polyporus ursinus* Lloyd. On pine logs. Tolland. July 18, 1913. No. 2016. I am indebted to Mr. C. G. Lloyd for the determination of this and the following species.

138. *Polyporus varius* Fr. On various kinds of dead wood. Tolland. June 20, July 7, 20, 1914. Nos. 1818, 1876, 1947.

This species is a close relative of *P. elegans*, having the general colors and the blackened stem of that plant.

139. *Trametes carnea* Fr. On coniferous wood. Golden. June 14, 1914. No. 1760.

140. *Trametes peckii* Kalchbr. Substratum unreported. Denver June, 1914. No. 1774. Collected by E. Bethel.

141. *Trametes protracta* Fr. On coniferous logs. Tolland. June 18, July 2, 1914. Nos. 1793, 1852.

This plant is by some regarded as the trametoid form of *Lenzites saepiaria*.

142. *Trametes serialis* Fr. On dead wood. Tolland. June 18, 1914. No. 1789.

10. FAMILY LYCOPERDACEAE[6]

143. *Bovista plumbea* Pers. On ground in dry grassland. Tolland. July 29, 1913; July 8, 1914. Nos. 1889, 2037, 3184.

144. *Calvatia caelata* Bull. On ground in open grassland or in thin forests. Tolland. July 8, 1913; June 16, 1914. Nos. 1742, 2006.

145. *Calvatia lilacina* Berk. On ground in dry grassland. Tolland. Aug. 4, 1914. No. 2102.

146. *Lycoperdon cepaeforme* Bull. On ground in pine woods. Tolland. July 29, 1914. No. 2075.

147. *Lycoperdon cruciatum* Roth. On ground in dry grassland or in thin woods. Tolland. July 29, Aug. 3, 1914. Nos. 2076, 2103.

[6] All determinations in this family were either made or verified by C. G. Lloyd.

148. *Lycoperdon gemmatum* Batsch. On ground in thin forests and in dry grassland. July 29, Aug. 3, 1914. Nos. 2077, 2087.
149. *Lycoperdon umbrinum* Pers. On ground in coniferous forests. South Boulder Cañon. July 8, 1914. No. 1881.
150. *Secotium acuminatum* Mont. On ground in dry grassland. Tolland. July 29, 1913. No. 2036.

12. FAMILY NIDULARIACEAE

151. *Cyathus vernicosus* DC. On old paper along stream in coniferous forest. Jennie Creek. Altitude 9,000 ft. July 7, 1914. No. 1873.

12. FAMILY PHALLACEAE

152. *Phallus impudicus* L. On the ground. Boulder. June 23, 1914. Collected by E. Bethel. No. 2859. Also collected by Dr. Ramaley at Boulder, May, 1912.

It is worthy of special note that both these collections were made in the spring. The specimens were in good condition and some were in the egg stage.

STATE COLLEGE, PA.

A NEW BALANSIA ON CYPERUS

C. W. Edgerton

(With Plate 12)

During the summer of 1917, an interesting species of *Balansia* was found attacking the fruiting parts of *Cyperus virens*. The fungus seemed to be of special interest as the described species of this genus are mostly listed as occurring on grasses. The region in which the specimens were found consisted of a low swampy sedge meadow in which *Cyperus virens* made up a considerable portion of the plant population. A large portion of the sedge plants of this species were attacked by the fungus. The fungus formed large black sclerotia in place of the fruiting parts, and as *Cyperus virens* is one of the very large sedges, diseased plants were very conspicuous. Specimens in all stages of development were found in abundance.

Cyperus virens develops in large stools often with fifteen to twenty or more flower stalks and it was interesting to note that a stool was either entirely healthy or else all of the flower stalks were diseased. Although a careful search was made, no stools were found which contained both healthy and diseased flower clusters. This held true even though the stools were touching each other or were interlaced. This seemed to show that the infection must have occurred very early in the development of the host plant or else the mycelium of the fungus was perennial.

The fungus is easily demonstrated in the very young flower buds. The young bud which would normally develop into a whole flower cluster is at first enclosed by the large leaves. A bud from a diseased stool has the appearance of being perfectly healthy, yet a cross section shows the mycelium to be abundant between the different parts. The host cells, however, do not appear to be injured in these very small buds. Buds were examined that were less than two millimeters in diameter.

The fungus sclerotium develops as the bud enlarges and emerges from the covering leaves. The mycelium develops within the bud and also forms a white layer over the outside (Fig. 1). On this white layer the conidial stage of the fungus develops. The short and narrow conidiophores form a very dense layer from forty to fifty microns thick over the surface of the sclerotium. The small hyaline conidia develop very abundantly often collecting in mucilaginous drops on the surface.

Following the conidial stage, the sclerotium continues to increase in size, turns black in color, and the exterior mycelial layer increases in thickness. The mature sclerotium (Fig. 3) consists of a mass of small nodules each representing one of the stems of the flower cluster. Sometimes these nodules are more or less separate but generally they are all cemented together in one mass. Frequently on drying, these separate to some extent. The interior of the sclerotium is typical of this genus, it being composed of both fungous and host tissues.

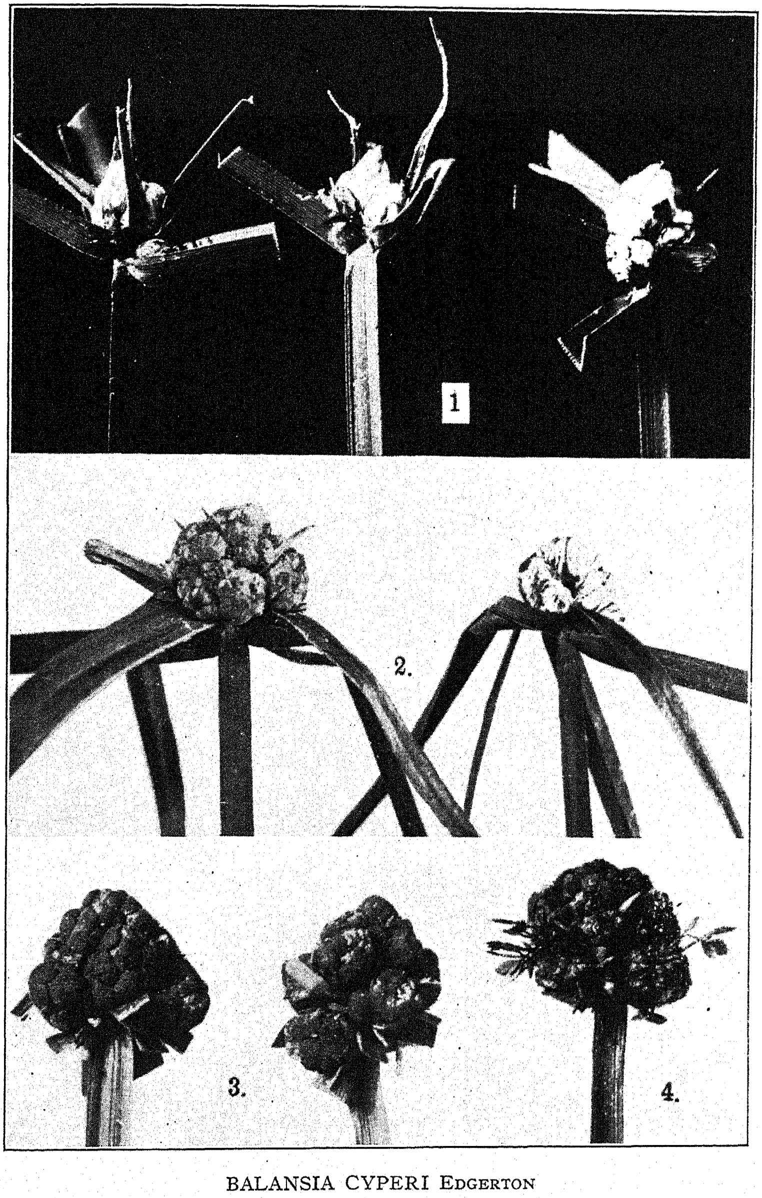
The perithecia of the fungus form in the black outer layer of the mature sclerotium. They are embedded in the tissue with only the ostioles extending slightly above the surface. The ascus has the peculiar bulbous apex found in other species of this genus.

Very seldom is there any development of the parts of the flower cluster of infected plants, though occasionally a stalk or two will push out of the sclerotium for a short distance and form rudimentary spikelets (Fig. 4). Sometimes when this happens, a secondary sclerotium will develop on this branch.

Specimens of this fungus were sent to the late Professor G. F. Atkinson, who had made considerable study of this genus, and he stated that it was undoubtedly an undescribed species. The technical description of the fungus follows.

Balansia cyperi sp. nov.

Sclerotium made up of fungous and host elements, developing in the flower cluster; sometimes one for each branch of the cluster but generally a large, compound, nodose sclerotium in place of the whole flower cluster; slightly stipitate or sessile, 1–3 cm. in diameter, white to greyish in color during early development, but black, hard and papillate at maturity. Conidia developing on



BALANSIA CYPERI EDGERTON

short narrow, crowded conidiophores on the white immature sclerotia, straight or slightly curved, long, narrow, sharp pointed, hyaline, 15–30 × 1–1.8 μ. Perithecia flask shaped with a somewhat thickened elongate neck extending to the surface of the sclerotium, 480–600 × 120–200 μ. Asci long, narrow, usually straight but sometimes curved, 160–225 × 7–10 μ. Ascospores long, narrow, hyaline, septate, 100–200 × 1.5–2 μ.

In fruiting parts of *Cyperus virens,* St. Gabriel, Louisiana, August 16, 1917, collected by A. T. Bell and C. W. Edgerton.

Type material in Herbarium of the New York Botanical Garden. Specimens also in Bureau of Plant Industry collections, Washington, D. C.

LOUISIANA AGRICULTURAL EXPERIMENT STATION,
BATON ROUGE, LA.

EXPLANATION OF PLATE 12

Balansia cyperi on *Cyperus virens*

Fig. 1. Young immature sclerotia with conidial stage.
Fig. 2. Older stage of sclerotia.
Fig. 3. Mature sclerotia with perithecial stage.
Fig. 4. Mature sclerotium with rudimentary spikelets of the host plant.

AN UNDESCRIBED TIMBER DECAY OF HEMLOCK

Erdman West

For several years, dead hemlock timber in the vicinity of State College, Pennsylvania, has been destroyed by a peculiar rot which seems to be quite constantly associated with sporophores of the fungus *Polyporus tsugae* (Murrill) Overholts. An investigation of the problem was undertaken at the suggestion of Dr. L. O. Overholts and a preliminary report of the situation prepared but not published. Soon after assuming his duties in New Jersey, the writer noticed a group of hemlocks along the Raritan River near New Brunswick, N. J. An excursion to these showed a large number of them dead or dying from the effects of the root rot fungus *Polyporus schweinitzii*. Some of the trees bore sporophores of the sap rot *Polyporus abietinus*, but most of the trees that had died recently, bore sporophores of *Polyporus tsugae*, sometimes in great abundance. Further investigation showed present in these standing trunks the same rot that had been studied in stumps and prostrate trunks of hemlock near State College. This abundant material has made further observations possible.

Polyporus tsugae (Murrill) Overholts has been reported on pine and hemlock for a number of years but the decay caused by it has never been described. The sporophore was first described by Dr. W. A. Murrill under the present specific name. He placed it in the section *Fomiteae* under the name *Ganoderma tsugae* along with several other species of *Ganoderma*. It is, however, an annual plant and the entire genus as limited by Dr. Murrill more properly belongs in the section *Polyporeae* instead of *Fomiteae*. This point will be given further consideration later. The species has also been referred to the genus *Polyporus* by another writer. The species is very closely related to *Polyporus lucidus* and *P. curtisii*.

Mr. C. G. Lloyd has repeatedly stated in his writings that *P. tsugae* is *not* a good species but only the coniferous wood form of *P. lucidus*. A careful examination, however, shows differences[1] that are sufficient to warrant its being retained as a separate species. First, the context in *P. lucidus* and *P. curtisii* is made up of two layers, the upper one quite whitish and the lower having brown hyphae running all through it, so that to the naked eye it appears brown; in *P. tsugae* on the other hand, the context is never duplex and does not have the brown hyphae, so that the context is light and concolorous from crust to tubes. The difference is very apparent when the pilei are cut vertically and compared. The red varnishing of the pileus is also very characteristic. In *P. lucidus* and especially in *P. curtisii* the red color fades into yellowish brown in spots in almost every specimen, such spots being of a dull color. In *P. tsugae* the pileus is of a dark red or mahogany color all over, with a bright glossy surface. This distinction holds good even in old herbarium specimens if mature when collected. Under the microscope, the type of the hyphae is a distinguishing character. In *P. lucidus* and *P. curtisii* the hyphae are rather slender, being about 4–10 microns in diameter on the average. The hyphae in these two species are not very abundantly branched though they cannot be said to be unbranched by any means. In *P. tsugae* there are slender hyphae but they are always abundantly branched. Besides there are numerous short thick hyphal elements that may be as high as 15 microns in diameter and of very various lengths. These have many small branchlets coming off at various points with many of these lateral hyphae branching several times and terminating abruptly near by. This branching is very conspicuous under high power of the microscope where hardly a hypha will cross the field without branching at least once, while in the other two species, unbranched hyphae crossing the field of vision were relatively frequent. The host may also serve as a guide to the species since *P. lucidus* and *P. curtisii* are, as far as the writer could find, always found on hardwoods, while *P. tsugae* is confined to coniferous wood, especially hemlock.

[1] Ann. Mo. Bot. Gard., 2, 1915. Comp. Studies Polyporaceae. Overholts.

As mentioned above, these three species have usually been grouped as a part of the genus *Polyporus,* or if given specific rank, placed in the section with *Fomes* as an exception to the perennial character. There is perhaps sufficient reason for giving this group specific rank, for the red varnished pileus, and the truncate, apparently echinulate spores are definite and fixed characters. The spores are especially exceptional. They appear to be echinulate, but closer examination shows, as Professor Atkinson pointed out, that the roughening is a sculpturing of the inner side of the spore-wall and not the outer as in the first impression. The species may be dscribed as follows:

POLYPORUS TSUGAE (Murrill) OVERHOLTS[2]

Pileus reniform or flabelliform, short stipitate when attached to trunks or stumps above ground level, longer stipitate when attached to roots, $5–15 \times 6–20 \times 1–4$ cm., with a mahogany colored or almost black, shining encrusted surface, glabrous, sulcate; context white or nearly so throughout, .5–2 cm. thick; tubes .5–1 cm. long, mouths white or brown, averaging 4–6 per mm.; stem lateral with color and context as in pileus, 3–15 cm. long, 1–3 cm. thick; spores ovoid with a truncate base, apparently echinulate, light-brown, $9–11 \times 6–7\,\mu$; hyphae very irregular and much branched up to $15\,\mu$ in diameter.

On standing or prostrate trunks, stumps, or exposed or nearly exposed roots of hemlock, *Tsuga canadensis,* probably with a range of its hosts. Occasionally on pine.

It has been reported from Vermont, New Hampshire, Massachusetts, New York, New Jersey, Pennsylvania, Ohio, West Virginia, and North Carolina.

The fungus is at first a sap-rot but it eventually destroys the heart-wood also. Near New Brunswick, a partly uprooted and leaning trunk 14 inches in diameter was entirely destroyed by this rot. Few stumps or dead trunks escape its attacks when it is present in a locality and since it is quite rapid in its work, it is a potential source of danger to stored hemlock lumber.

When first attacked, the wood turns a little darker in color and becomes dull and porous looking like a piece of fine grained blot-

[2] Polyporaceae Middle-Western U. S., L. O. Overholts. Washington University Studies, Vol. III, part I, No. 1. 1915.

ting paper. As the rot progresses, numerous checks or horizontal cracks appear. These do not appear to be due to shrinkage but rather to have been dissolved out by the action of the hyphae. They extend individually only through a single layer of spring-wood, but in the later stages of the decay, short vertical cracks connect the horizontal and a complete network is formed which becomes completely filled with white mycelium. The wood at this stage splits very easily along the annual rings into concentric layers. On the inner side of these layers, the network of cracks filled with the white mycelium, shows up very conspicuously. At the same time or a little before, numerous black dots make their appearance at irregular intervals throughout the decayed wood. They increase in number and sometimes form lines as the wood goes into the later stages of decay. They are more or less distinct in outline and are harder than the surrounding wood. They vary slightly in color but are usually so dark a brown that they appear black to the unaided eye. They are usually not more than a few millimeters in any dimension.

The fungus is primarily a cellulose destroyer but soon attacks lignified structures also. The mycelium attacks first the medullary rays and partially destroys them. All free cellulose is absorbed at this stage since various tests for it gave negative results in the rays and traceids alike. The fungus now fills the ray cavities with a mass of tangled hyphae, frequently containing some of the thick elements found in the context of the pileus. At this same time it attacks the tracheids, starting at the bordered pits. These are eaten out until only irregularly shaped holes remain. The hyphae may now pass easily from one tracheid to the next by simply dissolving a hole in the wall. The hyphae branch freely throughout the wood and seldom pass from one ray to the next without doing so. Clamp connections are very abundant and seem to be the rule. Occasionally they occur at branches and cause the mycelium to appear swollen at the joints, which is not really the case. As a rule the hyphae are hyaline, slender, 4–8 μ in diameter, except in the rays mentioned above, and are filled with many small oil globules. However where the black spots appear, the hyphae are often thicker and shorter jointed

and have a brown color. The brown color is due to the presence of small brown globules possibly of some substance from the wood, toxic to the fungus and isolated in these spots.

Chemical tests used to detect the presence of cellulose:

1. Iodine in KI solution followed by treatment with weak sulfuric acid (1–3) colors cellulose blue;

2. Chloriodide of zinc colors cellulose blue;

3. Iodine in alcohol colors cellulose faintly yellow.

Of lignin:

1. Iodine in alcohol colors lignin deep yellow;

2. Phloroglucin followed by hydrochloric acid colors lignin bright carmine red wherever present;

3. Carbolic acid and hydrochloric acid followed by exposure to daylight for an hour color lignin green.

The use of these tests showed the removal of the cellulose from the rays in the early stages. Soon afterward, however, the tracheids in the spring wood were attacked and the middle lamella laid bare, so that a test at just the right stage indicated a small amount of free cellulose present here. As the rot progressed, tests for cellulose failed altogether, and those for lignin grew fainter. However, phloroglucin and hydrochloric acid indicated a small amount present in the most rotten wood. This action of the fungus indicates that it secretes both lignin and cellulose dissolving enzymes during its development.

In some respects the rot is very similar to that caused by *P. borealis* in the same host. As that seems to have the checks in the spring wood also, the presence of the before mentioned black spots and lines in the case of the decay caused by *P. tsugae* is the chief means of identification when sporophores of the fungus are not present.

The rot can usually be detected, in the older stages at least, by the presence of the sporophores with their very glossy red surface and the white context from the crust to the tubes. The rot in the wood is characterized by its being primarily a sap rot (though it finally rots the heart-wood also) producing a porous condition, with numerous white checks in the spring-wood and blacks spots scattered through the rotted area.

NEW BRUNSWICK, N. J.

PINEAPPLE FUNGUS OR ENFANT DE PIN OR WABADOU

J. H. Faull

"There groweth also upon the larch tree a kind of mushrum or excrescence, not such as is upon other trees, but whiter, softer, more loose and spongie than any other of the mushrooms, and good for medicine, which beareth the name of *Agaricus* or Agaricke." In these words Gerard, in his Herbal (1597) for English readers prefaced his account of the polypore, *Fomes officinalis* (Vill.). This fungus grows on the larches, *Larix europaea* and *L. sibirica*, in many parts of Europe and Asia, and according to Marie[1] on the cedar of Lebanon in northern Africa. Comparatively recently it was discovered by botanists in America where it is now known to occur widely distributed and on at least sixteen species of coniferous hosts distributed among the genera *Abies, Picea, Larix, Tsuga, Pinus* and *Pseudotsuga.*

To modern botanists *Fomes officinalis*[2] is of main interest because of its parasitism and the decay it produces in timber; but formerly, back to earliest times, it was considered almost solely because of its medicinal value. Dioscorides, Pliny, Galen, and their successors down to the beginning of the last century accorded it an important place in their writings on medicinal plants, and it was recommended by them in the treatment of nearly all the physical and the mental ills to which man is subject. There

1 "Il a été retrouvé sur le cèdre par M. Trabut à Teniet-el-Had, et par nous-mêmes sur lé Haizer. Ce champignon agit, par l'acide agaricinique qu'il contient, en paralysant les nerfs des glandes sudoripares, d'où son emploi pour combattre les sueurs profuses des tuberculeux. A la dose de 2–3 gr., le *P. officinalis* produit de la gastro-enterite; mais il n'y a pas à redouter d'empoisonnements par ce champignon, sa consistance ne permettant pas son emploi en dehors de la thérapeutique." Maire, R.: "Les Champignons vénéneux d'Algérie"—Bull. de la Soc. d'Hist. Not.: 7: 203. 1917.

Cèdre—*Cedrus Libani* Barrel.

2 Faull, J. H.: Fomes officinalis (Vill.), A Timber-destroying Fungus, Trans. Roy. Can. Inst. 11: *pl. 18–25*, pp. 185–209. 1917. Full bibliography.

can be little question but that the knowledge of its powers was current among the inhabitants of Europe long before the era of materia medica and that many superstitions were associated with its use. But the history of *F. officinalis* in America is unknown, and because of this I venture to bring together a few fragments of information that have come to my hand.

Fomes officinalis grows on white pine (*Pinus Strobus*) practically throughout its range in Ontario and Quebec, and this is the only host that is definitely reported for these provinces. An Ojibway "medicine man," however, informed me that while commonest on white pine, he had also collected it from large tamaracks (*Larix laricina*) in the Georgian Bay Area, which seems quite probable as this host is recorded for Wisconsin, and hemlock (*Tsuga canadensis*), which, if so, is a new host, but never on red pine, jack pine, spruces, balsam, or arbor vitae. I could find no trace of it further north than within the southern limits of Temagami Forest Reserve, that is about 50 miles south of the northern range of *Pinus Strobus,* and even there it is rare, but from Georgian Bay, south and east it is so frequent as to be well-known to the Indians, lumbermen, and settlers both in Ontario and Quebec. With the cutting of the mature pine, however, specimens of the sporophores are no longer easily obtainable, and possibly at no time were abundant. According to the testimony of several people of whom inquiries were made, the fruiting bodies in some cases attain a very large size, up to 2 feet or more in length and of many pounds weight.

A plant so well-known was bound to receive a name; indeed, this plant bears at least three names, in as many different languages, and none of these even distantly resemble any of the common names employed in Europe. To the English settlers and lumbermen the punks of *Fomes officinalis* pass under the name "pineapple" or "pineapple fungus," to the French, "enfant de pin," and to the Ojibway Indians, "wabadou."

Elsewhere I have made a conjecture as to the origin of the term "pineapple," and have expressed the opinion that we have a retention here of a meaning akin to its original definition (pineapple tree was originally synonymous with pine tree, and meant

a tree on which pineapples, that is, cones grew). The French designation employs the word "enfant" in quite an ordinary sense, but its non-inclusion of other fungus growths on the pine indicates the special attention paid to this one. The Ojibway name "wabadou" is quite plainly a combination of the Indian "wab" which means white and "amadou,"[3] a French word for the tinder formerly made in Europe from the context of *Fomes fomentarius* and other bracket fungi, and still current among the French-Canadians for "punk." This derivation is all the more understandable when it is pointed out that all other fungus growths on trees without distinction are called "anadou"[4] by these Indians,—evidently a slightly corrupted form of "amadou" and an easy transition in application from tinder to the source of the tinder. To the Ojibways then the fruiting body of *Fomes officinalis* is simply "wabadou,"[5] contraction of wabamidou, that is *white tinder fungus*. It is interesting that the vocabulary of the Ojibways north of Lake Nipissing includes no names for any other species of fungi; so far as I could learn not one of the many species of mushrooms which in season abound in the forest is used by these Indians as food, and so there has been no occasion for enlarging their mycological nomenclature.

That the Indians have a special name for *Fomes officinalis* is good evidence of a long-standing use of this fungus aside altogether from certain superstitions held with regard to it, but this evidence is not sufficient proof that they knew of it prior to the coming of the Europeans, especially as the Indian name is evidently based on the French "amadou." The Georgian Bay country and eastward was much travelled over by French Jesuits, fur

[3] "Amadou" is of disputed origin. The most probable explanation is that it is derived from "amadouer" (Provençal) meaning to wheedle or coax (quite appropriately applied to a substance especially used for coaxing fire into being).

[4] In the closely related Cree language the names for "amadou" according to LaCombe are "pusagan," and "kutawagan."

[5] Through Mr. F. W. Waugh, I learn that there is an Ojibway word "wabado" meaning rhubarb—I presume the root of the medicinal Turkish rhubarb. As there is a similarity in taste and use of rhubarb and wabadou, it may be reasonably assumed that the term as applied to rhubarb is a borrowed one.

traders and coureurs de bois from Champlain's time and the Indians made annual visits to the French stations on the St. Lawrence many years prior to Champlain's explorations, so that it may well be that their first knowledge of it came from the French, some of whom would certainly be well acquainted with a plant so highly esteemed in European medicine at that time. It may be noted in passing, however, that Dr. D. Lyall, an English botanist attached to the British North American Boundary Commission, 1859–61, the discoverer of *F. officinalis* in America, reports that the Indians of British Columbia employed this fungus as a medicine. It is likewise interesting that *Fomes officinalis* was also probably employed by the Iroquois. Mr. F. W. Waugh, the author on an excellent work on "Iroquois Foods and Food Preparation" (Memoir 86, Geological Survey, Canada, 1916) writes me, "Among the Iroquois, the Cayuga, Mohawk, and probably other Iroquois tribes, a Fomes growing on *pine* is used as a medicine for a variety of diseases, reliance being placed on the supposed magical qualities of the fungus. Among the Onondaga it used to be shot with an arrow before being removed from the tree. It was prepared in the form of a decoction." Nevertheless, while it seems quite possible that the Indians knew of *F. officinalis* before the coming of the whites, no absolute proof has been yet adduced that such was the case. It may be that some one of the Jesuit Fathers has left a record that would furnish an answer to this question.

The Ojibway Indians still prize "wabadou" as a household remedy, considering it valuable for various internal complaints and at child birth. It is sometimes used dry, but is usually mixed with the sapwood of arbor vitae taken from "the south side of the tree" and boiled in water. The fruits, in the fanciful estimation of the Indians, are best when gathered in the spring, and in pulverizing should be scraped downward to be most efficacious. I learned from several independent witnesses that while the punks are of little value as charms and are sexless, yet they are surely living objects for they are reputed to change their position of their own accord, passing through the air from one tree to another, and moreover they make a sound (moaning or groan-

ing ?) somewhat like that of a man, by which means they are readily located in the still forest. Herbarium specimen No. 3525, University of Toronto Herbarium, is part of a large punk given to me by an Indian family at Bear Id., in Temagami Forest Reserve, which was located in this manner and shot down by two Indians on a hunting trip in the southern part of the Reserve about 25 years ago. As it is scarce on the Reserve a fragment is all they would willingly spare from their dwindling supply. How the punks originate and what their relation to the trees may be is a mystery. The Indians are certain they knew and used this plant long before the whites came, but, however that may be, it is certainly of great interest that their veneration of it finds a counterpart in the veneration manifested by the Europeans of more primitive days.

Mr. J. W. Bartlett, Superintendent of Algonquin Park, who has been intimately acquainted with the white pine areas of Canada for nearly half a century, informs me that it was well known to many of the early settlers and gathered by them for various purposes. He found it fairly common throughout the lumbering areas of Ontario and Quebec. Not only was it used medicinally but also in the making of home brewed beer, and as a substitute for hops in the making of yeasts. In the yeast making, the fungus was boiled as in the case of hops and the liquid put into the new yeast to "start it working," in fact it probably serves the same purpose as the lupulin of hops in holding bacteria in check and so giving the yeast a chance to grow. Mr. Bartlett learned of it from the settlers after he came to Canada more than fifty years ago but does not know the source of their information. A teacher in one of the mission schools in northern Ontario informed me that she had known of the "pineapple fungus" from earliest recollections and that it had been a household medicine in her home near Pembroke, Ontario. Her father would collect it in the forest when cutting the wood for the winter. It was regarded as especially valuable as a spring medicine and as such was copiously administered to the children in season. Similar information was received from various other persons in Ontario.

Mr. W. F. Atkinson, Forest Engineer for the Spanish River

Pulp and Paper Co., formerly of Quebec, and for many years associated with large lumbering interests there, was the first to inform me that the "pineapple" was well and widely known throughout the white pine belt of Quebec, but most commonly under the name "enfant de pin," and so far as he knew it grew on the white pine only. It is used by the habitants for various medicinal purposes and among others at child birth. The habitant, according to one of my French-Canadian informants, who himself carried a supply in his medicine cabinet, prepares the tonic by adding two tablespoonfuls of the powdered "enfant de pin" to a pint of gin; some of this, according to the age of the patient, diluted with water, makes a very efficacious remedy. This carries us back to Dioscorides, who concludes his discourse on "Agaricum," affirming that "On the whole, it is serviceable in all internal complaints when taken according to the age and strength of the patient; some should take it with water, others with vinegar and honey or with water and honey, and others with wine."

UNIVERSITY OF TORONTO,
TORONTO, CANADA.

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor.*]

Owing to the increased cost of publication, the price of MYCOLOGIA *will be advanced four dollars ($4.00) at the beginning of 1920. This price will also apply to back volumes; which can still be supplied in complete sets.*

Dr. Charles E. Fairman, of Lyndonville, New York, spent the first part of July studying certain collections of fungi in the herbarium of the Garden. He is preparing manuscript for *North American Flora.*

Mrs. Flora W. Patterson, mycologist of the Department of Agriculture at Washington, visited the Garden on June 24 for consultation regarding a group of fungi she is monographing for *North American Flora.*

Dr. C. T. Gregory, who for the past six months has been employed by the Department of Agriculture as extension pathologist in the control of truck crop diseases in Indiana, has accepted the position of plant pathologist of the Virginia Truck Experiment Station, Norfolk, Virginia.

Dr. M. F. Barrus has returned to Cornell University to resume his duties as plant pathologist after an absence of several months spent mainly in the employ of the Department of Agriculture as pathological adviser in extension work on the control of truck crop diseases in the North and West.

Dr. W. H. Tisdale, who left the Department of Agriculture a few months ago to become plant pathologist of the North Carolina Agricultural Experiment Station, has been reinstated and

will take charge of investigations of rice diseases, with headquarters in the Washington, D. C., laboratory.

A study of the relation of bacteria to cellulose fermentation induced by fungi with special reference to decay of wood, according to Henry Schmitz in the *Annals of the Missouri Botanical Garden* for April, shows that cellulose dissolving bacteria play no important part in the decay of wood under natural conditions. The rate of decay however is materially increased by the action of ordinary saprophytic bacteria. When autoclaved wood is used, the changes which it undergoes must be taken into consideration.—*F. J. Seaver.*

Mrs. M. F. Wheeler, curator in the department of botany of the Massachusetts Agricultural College, visited the Garden on June 25 and 27 to examine specimens of powdery mildews collected in Massachusetts. She is preparing a bulletin on this group of parasitic fungi to appear within a few months.

G. Arnaud, of the Station of Plant Pathology at Paris, has recently published an extensive work on the "Astérinées." The group as here considered not only includes most of the genera ordinarily included with the Perisporiales but many segregates from other orders and families. The entire work consists of 289 pages, 53 plates, a number of text-figures, and three maps. In addition to the systematic treatment, considerable space is devoted to climatology, geographic distribution, and the comparative morphology of the group.—*F. J. Seaver.*

A check list of the fungi of Porto Rico by Mr. John A. Stevenson, formerly pathologist in the Insular Experiment Station, has recently appeared. This list contains a record of all of the species of fungi and slime molds occurring in the island so far as known up to the date of publication. The species name is accompanied by the name of the host or substratum, the locality, and the collector when not collected by a member of the staff of the experi-

ment station. The entire work consists of 129 pages and is a valuable guide to the fungous flora of the island, as well as a basis for further study.—*F. J. Seaver.*

Dr. S. M. Zeller, who has been special investigator in timber pathology for the Southern Pine Association, of New Orleans, Louisiana, with a laboratory at the Missouri Botanical Garden, St. Louis, has been appointed investigator in fruit diseases at the Oregon Agricultural College, Corvallis, Oregon.

Bulletin 759 of the Bureau of Plant Industry, by Fred R. Jones, deals with the leaf-spot diseases of alfalfa and red clover caused by the fungi *Pseudopeziza Medicaginis* and *Pseudopeziza Trifolii* respectively. From his investigations he concludes that the two fungi are morphologically and physiologically distinct although they have been regarded by some as being identical. Of the several imperfect fungi which have been reported as the conidial stage of this fungus, none have been found to be related and no other spore form than the ascospore form apparently exists. Infection is produced by the direct penetration of the germinating ascospores through the cuticle and epidermal wall. The fungus overwinters on the dead leaves which escape decay and ascospores produced in the spring furnish the source of new infection.—*F. J. Seaver.*

In the report of the State Botanist of New York for 1917, just issued, Dr. H. D. House describes a new species of *Humaria* under the name of *Humaria Peckii.* The species occurs on decaying hay and is accompanied by a *Sclerotium.* In the same report a number of new species belonging to various groups are described by Dearness and House. The bulletin also contains an article by G. F. Atkinson on *Collybia campanulata* Peck and its near relatives in the eastern United States, and one by Dr. L. O. Overholts on the species of *Poria* described by Peck. The last article is illustrated by twenty-three plates.—*F. J. Seaver.*

Dr. Fred J. Seaver spent the first week of June at Ithaca, New York, collecting fungi in collaboration with Cornell University, the Brooklyn Botanic Garden, and Syracuse University. Three main excursions were made, one to Enfield Gorge, one to Labrador Lake, about forty miles from Ithaca, and one to the bogs of Mud Pond Basin near McLean. Other local trips were made in the gorges immediately adjacent to the college campus. Where necessary, transportation facilities were provided by the extension cars of the Agricultural College and the various trips were attended by a number of the graduate students and staff of the department of plant pathology under the direction of Professor H. H. Whetzel. While an exact count has not yet been made, the trip will probably add more than two hundred specimens of ascomycetes and parasitic fungi to our collection. No special attention was given to the higher fungi, since no one of the party was particularly interested in them.

METAPHANIC AND PROGRESSIVE VARIATION IN BEAUVERIA: ITS PHYLETIC SIGNIFICANCE

The fungi of the Conidiosporae class are subdivided into 4 groups from the spore formation: 1°, Sporotrichae, where mycelial hyphae directly yield conidia, 2°, Sporophorae, where conidia bud from sporophores, 3°, Phialidae, where conidia are formed from a differentiated bottle-like hypha called "phialida," and 4°, Prophialidae, where the phialides, instead of springing from undifferentiated vegetative hyphae, are only produced by peculiar hyphae termed "prophialides."

Daily observation of *Beauveria globulifera,* collected from mummified moths of *Cnethocampa pityocampa* in Arcachon, and cultivated in hanging drops, shows that spore formation, in this typical Philalidae, is at first a mere process of budding,—as in Sporophorae,—and differentiates to the complex conidial system of Prophialidae, as the cultures age.

1. So long as the cultures are less than 10 days old the end of the big mycelial hyphae may bud into great, oval, isolated conidia, as is only observed in Sporophorae.

2. In cultures 10 to 12 days old, undifferentiated cylindrical phialides form single, round, small conidia at the end of their thread-like summit.

3. The base of the phialide becomes swollen, while other conidia are formed basipetally below the terminal one, so that the phialide terminates into a zig-zag sporiferous thread as is typical in *Beauveria.*

4. The phialides may become forked, and yield several zig-zag sporiferous threads.

5. Phialides group by twos on vegetative hyphae, and the phialidiferous parts of the hyphae become swollen.

6. Typical phialides group into a glomerule at the end of a differentiated phialidiferous hypha, which may be termed a prophialide, such as exists in the Prophialidae.

Undifferentiated conidial threads have been interpreted by Vuillemin as regressive phialides in *B. Bassiana.* But it appears that all the conidial forms which we have recorded are normal phases of the ontogenic development of *Beauveria,* and they seem to be of phylogenetic significance, as they actually link the *Beauveria* both to the lower and to the higher Conidiosporae.[1]

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JEAN DUFRENOY

COLLECTING FUNGI IN VIRGINIA

During the latter half of July, 1919, the writer made a tour through parts of southwest Virginia, returning by way of Blue Ridge Springs, Bedford City, Lynchburg, and Falls Church. A drought early in the month was followed by over a week of rain, which brought out an unusually large and diversified crop of

[1] We are indebted to Professors A. Guilliermond and J. Beauverie for the determination of the *Beauveria* and helpful suggestions.

fungi. These were studied and collected for several days in the vicinity of Blacksburg, Virginia, at an elevation of 2,200 feet, where the woodlands are mostly oak-chestnut and the rocks Trenton limestones or subcarboniferous shales and sandstones.

Many of the gardens, vineyards, and orchards were severely injured by the rainy weather, various wilts and rots having developed in abundance. Trees were attacked by destructive polypores, among them *Bjerkandera adusta, Coriolus versicolor, Daedalea quercina, Elfvingia lobata, Fulvifomes Robiniae, Grifolia Berkeleyi, Laetiporus speciosus, Porodaedalea Pini, Trametes robiniophila,* and *Tyromyces Spraguei.* The most abundant of these were probably *Fulvifomes Robiniae* on black locust and *Elfvingia lobata* on various species of oak, hickory, and maple. This latter species seems to entirely take the place of *Elfvingia megaloma* in that section, and its annual habit and other distinguishing characters are plainly marked.

The forest floor was covered with fungi of all kinds, this being the first and probably the largest crop of the season. Most abundant and conspicuous among the fleshy forms, was *Lactaria piperata,* growing in large patches and reaching the size of ordinary breakfast plates. *Lactaria volema* was also common, while *L. corrugis* was found only once. *Russula virescens, R. foetens, R. emetica,* and several purple species were seen, but the genus was not yet well represented.

Venenarius phalloides, V. rubens, V. Frostianus, and *V. solitarius* were found, but it was probably too early for *V. cothurnatus,* which was not seen in the places where it grew several years ago. The genus *Vaginata* was very well represented. *Vaginata plumbea* occurred in all color-forms; the rare *V. parcivolvata* was found twice; and *V. farinosa* once.

The Clavarias had not yet appeared; while the Hydnums were represented by *H. adustum* and *H. repandum.* Three puffballs were seen, and *Dictyophora duplicata* was unusually abundant and offensive in gardens and about bulidings. *Boletus communis, B. griseus, B. luridus, B. felleus,* and *B. bicolor* were the only members of the Boletaceae yet in evidence.

Of the fleshy forms that were eaten, the following might be mentioned: *Chanterel Chantarellus, Craterellus cornucopioides, Lycoperdon cyathiforme, L. gemmatum, Cortinarius semisanguineus, Vaginata plumbea, Lactaria volema, L. corrugis, Hydnum repandum, Boletus bicolor, Pluteus cervinus,* and *Hypomyces Lactifluorum.* Those specially avoided were species of *Venenarius* and brilliant clusters of *Clitocybe illudens.*

At Blue Ridge Springs, an unusual leaf-spot disease had almost defoliolated several box-elders and Norway maple trees, the spots being so thick on many of the leaves as to be confluent. Beneath the maples, the large diseased leaves were heaped up as though a heavy frost had occurred.

The elms at Bedford City were found to be riddled by the imported elm leaf-beetle, which, according to an observing resident physician, had been abundant there every season. No one has yet satisfactorily explained why this pest has not been seen about New York during recent years, but it may possibly have been due to adverse weather conditions.

One of the most interesting observations was made at Lynchburg, at the corner of Tenth and Harrison Streets. Here stood and English walnut tree over a hundred years old, which measured seven feet in circumference and about sixty feet in height, and had borne quantities of good nuts until about 1915. Since then, however, the nuts had been diseased and for the most part worthless. Upon closer examination, some of the green fruits hanging on the tree were seen to be partially blackened, while many entirely blackened and decayed fruits were on the ground. The origin of this tree is unknown. It usually flowers in March and the fruit is often killed by frost. This year, however, was exceptional and the flowers appeared in February. The foliage has never been diseased. Nuts from this tree have been widely planted. A few blocks away there are two daughter trees which bear fine, healthy fruits; and the same is true of two large trees at Rustburg.

W. A. MURRILL

SEXUALITY IN THE BASIDIOMYCETES:—A REVIEW OF

BENSAUDE, MATHILDE. Recherches Sur Le Cycle Evolutif Et La Sexualité Chez Les Basidiomycètes. *Pp. 1–156, pl. 1–13, figs. 1–30.* Nemours, 1918.

The author of this extensive and what appears to be an exhaustive study of the nuclear phenomena in the mycelia of several Basidiomycetes brings again into the foreground the fundamental problem in the mushrooms, namely their sexual reproduction.

Miss Bensuade confirms in a measure the observations of Kniep (1915, '16, '17) who found that the clamp connections at the cross walls of hyphal cells serve the purpose of keeping the two nuclear elements of the "*dicaryon*" apart and thus insure the maintenance of two distinct lines of descent for the nuclei which fuse in the basidium. Kniep claimed that the origin of the binucleated condition is by the division of the nucleus of a uninucleated cell. Miss Bensaude argues for the sexual significance of the familiar hyphal anastomoses. Through the agency of anastomosing cells (plasmogamy or pseudogamy) the binucleated condition arises and this is perpetuated by conjugate division in connection with clamp formation till the nuclei fuse in the basidium.

The mycelia of three autobasidiomycetes, *Coprinus fimetarius* Fries, *Armillaria mucida* Schrad., and *Tricholoma nudum* Bull., were studied in considerable detail. The author found Bouin's picroformol the most satisfactory fixing agent and iron haematoxylin counterstained with eosine, light-green, or fuchsin, the most desirable staining method. The work proper may be divided into two parts: one dealing with the morphology and cytology of the mycelia in general and the other with the study of single spore cultures.

The studies of mycelia were made on spore cultures and mycelia gathered from the field. The author accepts R. Falck's classification of the mycelia into primary, secondary, and tertiary forms, and claims that during the first few days after germination the mycelium produced is primary in that the hyphae are more or less partitioned off into cells which have from one to

several nuclei, and also that in no case are clamps to be found at the cross walls. At this stage certain uninucleated cells give rise to varying numbers of oidia. Miss Bensuade claims that these oidia germinate. Disarticulated hyphal cells ("*pseudoidia*") are also formed which may also grow into mature mycelia. Her evidence on this point is not at all convincing. Pure cultures from isolated oidia were not made. The author further claims that these oidia may fuse with a hyphal cell and thus initiate a series of binucleated cells and ultimately the development of a carpophore.

The author grew spores of *Coprinus fimetarius* in Van Tieghem cells and succeeded in removing all but one spore so that pure cultures from single spores were obtained. Ten spores were so isolated, of which four developed mycelia. These showed all the characteristics of primary mycelia. No persistent binucleated cells were found and clamp connections did not appear at the cross walls. Of these cultures, two were transferred to media where it was possible to observe their growth for about eight months. During this period these cultures showed no carpophore development and the mycelia remained of the primary type. When portions of each of these two mycelia were planted side by side, thus forming a mixed culture, the secondary mycelial type appeared and fruit bodies were shortly afterward formed. However, the author concludes that the "*dicaryon*" does not appear in monosperm cultures of *C. fimetarius* and that the binucleated cells are formed following plasmogamy between cells coming from two different thalli. The most common method of bringing about these cell fusions is through the union of an oidium with a hyphal cell of a different mycelium. The fact that Brefeld obtained carpophores from single spore cultures of *Coprinus lagopus, C. stercorarius,* etc., only leads Miss Bensaude to conclude that some basidiomycetes are homothallic and others heterothallic, resembling in this the conditions described by Blakeslee for the Mucorineae.

The author admits that transformation of a primary into a secondary mycelium is very difficult to observe, but from her study of these single spore cultures, Miss Bensaude concludes

that after the anastomosis of two hyphal cells of different thalli, the primary mycelium takes on the characteristic of the secondary one. Through this anastomosis (plasmogamy) of cells the cytoplasm as well as the nucleus or nuclei of one cell may pass into the other. The fusion of two cells with more than two nuclei generally results in the disintegration of the superfluous ones. Unfortunately, the cytological evidence offered for this most interesting claim is altogether insufficient and the figures are quite inadequate.

The most aberrant feature in the author's results is the claim that the nuclei of the early germ tube divide amitotically. Here again the evidence does not appear to be satisfactory. Two nuclei lying close together with imperfectly stained nuclear membranes do not indicate all the conclusions that the author suggests; nor in my opinion do dark or heavily stained protoplasmic strands between two nuclei suggests anything more than imperfect staining. It seems that Flemming's Strong Solution destroys the delicate spindle fibers in the fungi. The claim that in young hyphae the nuclei rarely ever show chromatin seems to be a retrogressive step in the cytology of the fungi. A number of students of the Ascomycetes, as well as the Basidiomycetes have shown rather clearly that the nuclei of the hyphae in these fungi are quite like those of higher plants.

As noted, Miss Bensaude's account of conjugate nuclear division and the formation of clamp connections agrees with that of Kniep. The nuclear division is, as a rule, preceded by the formation of a protuberance in the middle of the cell which is to develop into a clamp. The nuclei migrate into the region of the cell where this protuberance is formed. One of the nuclei which Miss Bensaude now calls plus enters this rudimentary clamp and the other minus remains in the hyphal cell. Spindles are formed lying parallel to each other and the nuclei divide. One of the plus daughter nuclei passes back into the mother cell and the other goes to the tip of the little beak. One of the minus daughter nuclei goes to the apical portion of the mother cell, the other to the basal part. Two contiguous cross walls are formed, one at the base of the young clamp and the other in the mother

cell at the level of the clamp. The apical cell so formed has a plus and a minus daughter nucleus. The basal cell has a minus nucleus and the young clamp has a plus nucleus. Fusion now occurs between the basal cell and the young clamp and the nucleus of the clamp passes into the basal cell so that it too has a minus and a plus nucleus.

At times the clamp fuses with what will be the future basal cell before the nuclei divide, so that the apical and basal cells both contain two nuclei before cell division occurs. Intercalary cells may also divide and the nuclei here also undergo conjugate division. Conjugate nuclear and cell divisions are always associated with the formation of a clamp connection. Occasionally, however, a reversion of the characteristics of secondary mycelia to those of the primary type occurs; in which case, cells are found in the secondary hyphae which have no clamps and which produce oidia.

This admission by Miss Bensaude makes us feel that the classification of the mycelia has no real basis, for uninucleated cells and binucleated cells with clamps have been observed by others, and Kniep (1915) claimed that the binucleated condition of the cells once established, it is never interrupted. The point, undoubtedly, needs further study.

Miss Bensaude's problem is a difficult one. Her work is highly commendable, for it clearly shows the necessity of working with cultures from single spores. Her figures are undoubtedly faithful representations of her preparations, but her interpretations are not adequately supported. The results she presents are theoretical possibilities but the evidence falls short of being convincing and conclusive.

MICHAEL LEVINE

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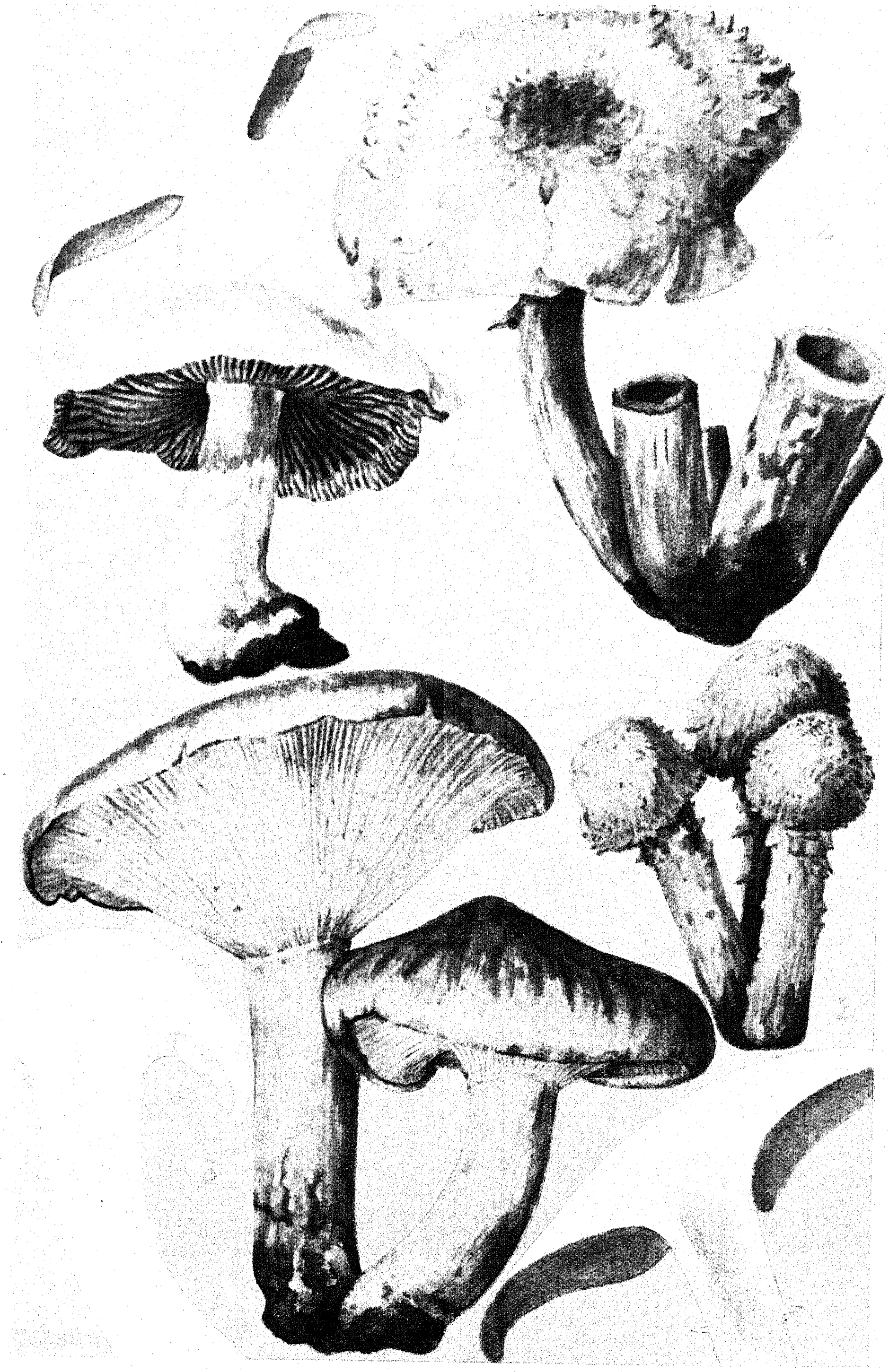


ILLUSTRATIONS OF FUNGI

MYCOLOGIA

VOL. XI   NOVEMBER, 1919   No. 6

ILLUSTRATIONS OF FUNGI—XXXI

WILLIAM A. MURRILL

The three species of gill-fungi shown on the accompanying plate are all edible and conspicuous by reason of their size or brilliant coloring. It is unfortunate that more space is not available for their adequate representation.

Cortinarius alboviolaceus (Pers.) Fries

PALE-VIOLET CORTINARIUS

Plate 13. Figure 1. × 1

Pileus fleshy, bell-shaped to convex with a broad umbo, gregarious, 3–6 cm. broad; surface smooth, dry, shining, appressed-silky, pale-violaceous to caesious-buff, soon becoming silvery-white with a violet tint; margin persistently decurved; context caesious or violet-tinted, of mild flavor; lamellae adnate to emarginate or slightly decurrent, rather broad, crowded, pale-violet to ashy-purplish when young, soon becoming paler and at length cinnamon-brown, eroded-crenulate on the edges; spores ellipsoid, rusty-brown, variable in size, slightly roughened, 6.5–9 × 4–5 μ; stipe tapering upward from a thickened base, spongy-stuffed, 4–8 cm. long, 5–20 mm. thick, violaceous above, usually peronate by the universal veil, which is thin, soft, white, appressed, and silky-interwoven.

This pretty, pale-violet species is common in late summer and autumn among leaves or humus in thick woods throughout most of temperate North America and Europe. It grows gregariously and is abundant enough to use for food. I have often eaten it in

[MYCOLOGIA for September (11: 231–287) was issued October 18, 1919]

the Adirondacks and elsewhere. Insects are very fond of it. When dried, specimens become so much paler that they are hardly recognizable.

Pholiota squarrosoides Peck

SHARP-SCALE PHOLIOTA

Plate 13. Figure 2. × 1

Pileus fleshy, firm, subglobose when young, at length convex, usually densely cespitose, 3–10 cm. broad; surface whitish, viscid when moist, adorned with erect, pointed, terete, tawny scales more abundant on the disk; context white, rather thick, edible; lamellae adnate or arcuate, often sinuate with age, rather narrow, crowded, whitish, becoming brownish-ferruginous; spores short-ellipsoid to ovoid, smooth, rusty-brown, $5–5.5 \times 2.5–3.5\,\mu$; cystidia scattered, about $30\,\mu$ long, obtuse at the apex; stipe equal, solid or stuffed, smooth and white above, rough below with numerous recurved, tawny scales; annulus floccose, lacerate.

This species was carefully studied by Dr. Peck in the Adirondacks, where he found it growing in clusters on dead logs and stumps of the sugar maple, and more rarely on beech and a few other deciduous trees. According to him, the flesh is firm and of excellent flavor. Prof. Hard found it in Ohio late in the fall, reporting it as especially frequenting hollow stumps and logs of the sugar maple. Dr. Kauffman reports it as frequent in certain parts of Michigan, occurring in very dense clusters on living trunks of maple, birch, and beech, as well as on dead logs and stumps of various deciduous trees.

According to Dr. Peck, it may be distinguished from the European species, *Pholiota squarrosa* Müll., by its "viscid pileus, its compact, erect, pointed scales, its sinuate lamellae and its brownish ferruginous spores." He reports *P. squarrosa* as not very common, occurring in dense tufts on dead wood in August and September.

According to Dr. Kauffman, *Pholiota squarrosa* differs from *P. squarrosoides* in the "color of the young gills, the disagreeable odor, the yellow flesh, the crocus-yellow or tawny color, and the larger, smoother spores."

I have a young specimen from Redding, Connecticut, collected

by Earle, who described it as "white with brown scales." This matches Peck's specimens of *P. squarrosoides* at Albany exactly. I also have larger specimens, which I collected in 1912 on a sugar maple log on the grounds of the Lake Placid Club. These resemble typical *P. squarrosoides* in appearance and grew on its usual host, but they had the strong, unpleasant odor of the European *P. squarrosa,* which can never be forgotten when once experienced.

I went out on a short collecting trip to the south of Upsala, Sweden, on the afternoon of October 12, 1910, and found a large cluster of *P. squarrosa* in the hollow trunk of a partly dead *Salix alba*. The caps were large and covered with large, erect scales, and the stems were very long. It agreed perfectly with specimens in the Fries Herbarium and also with specimens from Bresadola. I took the plants to my room at the hotel and placed them about the porcelain stove to dry while I slept; for the weather was cold and snowy and the stove contained a little fire. I lay down and tried to sleep, but all night long there was that strong, disagreeable odor in my nostrils, unlike anything I had ever smelt before. I can remember it yet; and I have had no difficulty in recalling it when I collected specimens with the same odor since.

On September 23, 1912, I was out collecting with Mr. Field at Stockbridge, Massachusetts, when I found by the roadside at the base of an apple-tree a large, dense cluster of mushrooms, which I called *P. squarrosa* at the time because they had the same strong odor experienced in Sweden. The taste was watery and not particularly unpleasant. I brought the cluster home and Miss Eaton made from it the drawing shown on the accompanying plate.

Melanoleuca Russula (Scop.) Murrill

Tricholoma Russula Gill.

REDDISH MELANOLEUCA

Plate 13. Figure 3. × 1

Pileus fleshy, convex, becoming plane or centrally depressed, obtuse, solitary or subcespitose, 7.5–12.5 cm. broad; surface viscid when moist, smooth or dotted with granular squamules on the disk, pale-pink or rose-red suffused at times with yellowish stains

or purplish streaks; margin usually paler, involute and minutely downy in the young plant; context white, sometimes tinged with red, the taste mild; lamellae subdistant, rounded behind or subdecurrent, white or yellow, often becoming red-spotted with age; spores ellipsoid, $6–7.5 \times 4\,\mu$; stipe solid, firm, dry, white, often reddish below, squamulose at the apex, 3–7 cm. long, 1.5–2.5 cm. thick.

This species was figured in *Mycologia* for September, 1915, the form there represented having a pale-pink surface with yellowish stains, and white gills. The form here shown is much redder and the gills are yellowish. The plant is frequent, either growing singly or in clusters, under oaks or in mixed woods in the northeastern United States, although not abundant enough to consider for table use. Dr. Peck agrees with McIlvaine that it is delicious; and it certainly has that appearance. The name refers to its resemblance to *Russula,* but the context is firm and not vesiculose, while the spores are very distinct. Mrs. Delafield found the deep-red form at Buck Hill Falls, Pennsylvania, in August of this year and sent in a specimen of it to the Garden herbarium.

NEW YORK BOTANICAL GARDEN.

THE OCCURRENCE OF BULGARIA PLATYDISCUS IN CANADA

A. W. McCallum

(With Plate 14)

Between May 9 and 15 of this year, collections of a rather rare and remarkable fungus were made at Val de Bois, P. Q., in the valley of the Lièvre River by Mrs. R. A. Inglis and Mrs. H. T. Güssow. The plants which were collected—15 to 20 in number—were gregarious in habit, occurring within the space of a few square feet, and nowhere else could others be found. They were growing beneath some coniferous trees in a bed of needles and humus, and from a distance they appeared like small stumps of young black birches—perfectly flat tops from one to two inches above the ground. At this time they were immature.

When the plants were received at this laoratory, several were placed in a moist chamber and allowed to come to maturity. In size, the apothecia varied from 6–10 cm. in width by 4–8 cm. in height. They were globose, sessile, dull-brownish-black in color, spongy in texture and furrowed both vertically and horizontally. Attached to the base were a few fine, branched, rhizomorph-like strands. The exterior of the apothecia was covered by a dense, felty layer of dark-brown hyphae, up to 400 μ in length and 10 μ in diameter, multiseptate and somewhat constricted at the septa. These hyphae arose from the outer side of a single row of very dark brown, rounded, pseudoparenchymatous cells. Arising from the inner side of this same row of cells, and forming a tangled network in the colorless jelly-like mass which occupied the whole interior of the apothecia, were innumerable, slender, hyaline hyphae, 4–5 μ in diameter. These assumed the most fantastic tendril-like forms and showed very curious connections. A spiral formation of these hyphae was very common. Probably their function is to give stability to the jelly-like contents of the apo-

thecia and the spiral and other irregular formations are to allow for expansion of the apothecia due to growth. The hymenium was deep-olive-green to black in color, velvety in texture, sinuate in outline and slightly concave. The asci were cylindrical, rounded at the tops, up to 425 μ long, 15 μ broad, and 8-spored. The spores were ellipsoid, smooth, subhyaline, 1-celled, 28–34 μ by 11–15 μ, uniseriate. The paraphyses were septate, rarely branched, colorless and slightly swollen at the tips, downward becoming brown, 5 μ in diameter.

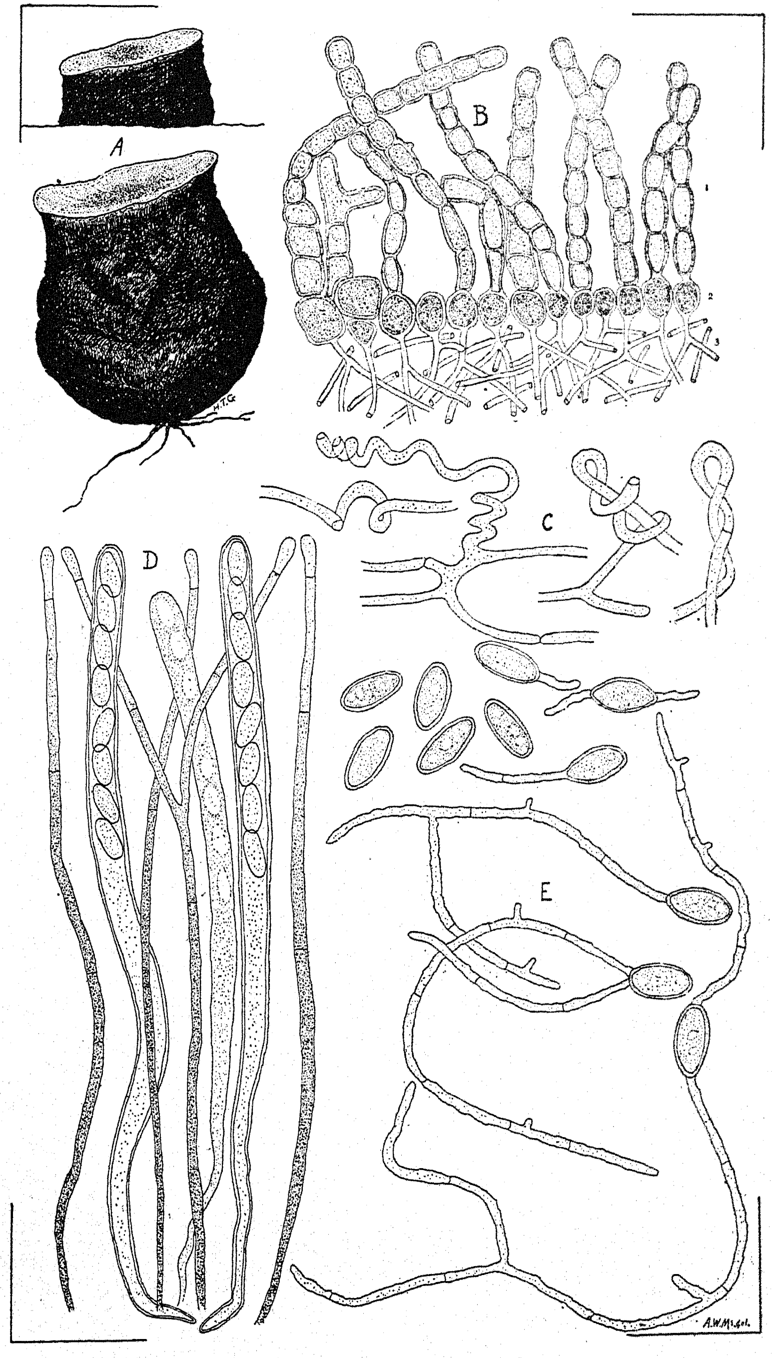
In an attempt to obtain pure cultures of the fungus, poured plates of nutrient media were placed over pieces of the hymenium which were discharging spores, but every plate became contaminated, probably because foreign organisms became attached to the spores as they passed out through the tips of the asci. This, however, did not prevent a study of the germination of the spores, which occurred in 12–15 hours. Two different media were used —potato agar and Czapek's agar.[1] Upon the latter the germina-

[1] Distilled water	1000.00 c.c.	Ferrous sulphate	0.01 gr.
Magnesium sulphate ...	0.50 gr.	Sodium nitrate	2.00 gr.
Dipotassium phosphate.	1.00 gr.	Cane sugar	30.00 gr.
Potassium chloride	0.50 gr.	Agar	15.00 gr.

tion percentage was very high and almost in every case it was bipolar, while upon the potato agar the germination percentage was low and usually but one germ tube was produced. The high germination percentage resulting from the use of Czapek's agar suggests its use in the case of spore germination in certain of the higher fungi where the spores are very resistant. The spores also germinated freely in tap water, though usually but one germ tube was produced.

Regarding the systematic position of this form, the writer believes that he is correct in naming it *Bulgaria platydiscus* Casp. It agrees very closely with the admirable description of *Sarcosoma globosum* var. *platydiscus* Casp. given in Rabenhorst.[2] In the appendix of this volume, Rehm writes of *Sarcosoma platydiscus* Casp.: "Nachdem die Beschreibung von *S. globosum* völlig verschiedene Sporen erweist, ist dieser Pilz also selbst-

[2] Rehm in Rabenhorst's Kryptogamen-Flora 5: 98. 1896.



BULGARIA PLATYDISCUS CASP.

ständige Art zu erachten." The spore measurements given for *S. globosum* are 8–10 μ long and 5–6 μ wide. Sarcosoma and Bulgaria are synonymous.

Central Experimental Farm,
Ottawa, Canada.

Explanation of Plate 14

A, young and mature apothecia of *Bulgaria platydiscus; B,* section through the wall of the apothecium showing (1) the felty layer of brown, multiseptate hyphae, (2) the single row of rounded, pseudoparenchymatous cells, and (3) the network of hyphae which permeates the jelly-like contents of the apothecium; *C,* drawings to show a few of the curious forms assumed by the hyphae in *B,* 3; *D,* asci and paraphyses, the tips of the latter slightly club-shaped; *E,* some mature spores and various stages in their germination.

ADDITIONS TO LICHEN DISTRIBUTION IN NORTH AMERICA

Bruce Fink

Some of the material which has been accumulating in my herbarium for many years has not been published. By far the greater portion of this is mainly of interest to those for whom the determining was done, but somewhat more than 200 species are worth recording as additions to distribution.

Many of the species recorded in this paper were collected by the writer, on the islands of Puget Sound, during a sojourn of six weeks at the Seaside Station of the University of Washington, in the summer of 1906, with headquarters at Friday Harbor, on San Juan Island. On the return trip, a week was spent at Glacier, British Columbia, and Laggan, Alberta. At these two places high elevations were reached, and much interesting material was secured, part of which is recorded in this paper. Little has been recorded definitely for any of these places in way of lichen distribution, though the areas are covered in a general way, for many of the species, in Tuckerman's Synopsis.

For several years the writer determined lichens collected by L. H. Pammel in the western mountains. Colton Russell sent specimens from Missouri and other western states many years ago. T. C. Frye sent a considerable number from the Olympic Mountains in Washington, and E. T. Harper has added to the list by collections from several areas. Several other botanists and zoölogists have added somewhat to the list published herein.

The list follows, given for distribution, and divested of all other non-essential data. Where no collector is named, the collecting was done by the writer.

Acarospora cervina (Wahl.) Koerb.

Waldron Island in Puget Sound, 1906, rocks.

Acarospora chlorophana (Wahl.) Ach.

Socorro County, New Mexico, Coll. C. J. Herrick, 1895, and near Glacier, British Columbia, 1906, rocks.

Acarospora fuscata (Schrad.) Arn.
Islands of Puget Sound, 1906, rocks.

Acarospora glaucocarpa (Wahl.) Ach.
San Juan Island in Puget Sound, 1906, limestone.

Acarospora glebosa Koerb.
Boone County, Iowa, 1903, sandstone.

Acolium tympanellum (Ach.) DeNot.
Islands of Puget Sound and near Glacier, British Columbia, 1906, bark and decorticate wood. Thallus often poorly developed.

Amphiloma lanuginosum (Hoffm.) Nyl.
San Juan Island in Puget Sound, 1906, and Madison County, Kentucky, 1908, various shaded substrata, in moist places.

Arthonia impolita (Ehrh.) Borr.
San Juan Island in Puget Sound, 1906, red cedar wood.

Arthopyrenia gemmata (Ach.) Mass.
Stewart's Island in Puget Sound, 1906, maple bark.

Arthopyrenia glabrata (Ach.)
San Juan Island in Puget Sound, 1906, bark.

Arthopyrenia quinqueseptata (Nyl.) Fink.
Boone County, Iowa, 1903, bark.

Bacidia akompsa (Tuck.) Fink.
Islands of Puget Sound, also Longmire Springs, Washington, Coll. E. T. Harper, 1906, bark.

Bacidia dryina (Ach.).
Islands of Puget Sound, 1906, cedar bark.

Bacidia schweinitzii (Tuck.) Fink.
Missouri and Arkansas, Coll. Colton Russell, 1899, bark.

Biatorella clavus (Lam. & DC.) Th. Fr.
Colorado mountains, Coll. L. H. Pammel, 1904, rocks.

Biatorella geophana (Nyl.).
Islands of Puget Sound, 1906, moist clay.

Biatorella pruinosa (J. E. Smith) Fink.
Cole County, Missouri, Coll. Colton Russell, 1898, shaded rocks.

Biatorella simplex (Dav.) Br. & Rostr.
Iron County, Missouri, Coll. Colton Russell, 1898, shaded rocks.

Biatorina bahusiensis (Blomb.).
Near Laggan, Alberta, Coll. Carolyn Crosby, 1901, rocks.

Biatorina chalybeia (Borr.) Mudd.
Near Minneapolis, Minnesota, 1896, limestone.

Biatorina cyrtella (Ach.) Nyl.
Near Duluth, Minnesota, 1898, poplar bark.

Biatorina laureri (Hepp.).
Islands of Puget Sound, 1906, bark.

Biatorina prasina (Fr.) Fink.
Shushan, New York, Coll. Frank Dobbin, 1907, bark.

Biatorina tricolor (With.) Fink.
Islands of Puget Sound, 1906, bark and wood. Inconspicuous and seldom collected.

Bilimbia hypnophila (Ach.) Th. Fr.
San Juan Island in Puget Sound, 1906, mosses over rocks.

Buellia colludens (Nyl.) Tuck.
Madison County, Missouri, Coll. Colton Russell, 1906, exposed sandstone.

Buellia leptocline (Flot.) Mass.
Islands of Puget Sound, 1906, rocks. Little known in North America.

Buellia papillata (Sommerf.) Tuck.
Near Laggan, Alberta, 1906, mosses at 9,000 feet.

Buellia stellulata (Tayl.) Br. & Rostr.
San Juan Island in Puget Sound, 1906, rocks.

Buellia turgescens (Nyl.) Tuck.
San Juan Island in Puget Sound, 1906, old boards.

Calicium curtum Borr. & Turn.
San Juan Island in Puget Sound, 1906, dead wood.

Calicium hyperellum Ach.
Near Glacier, British Columbia, 1906, bark of conifers. Not often collected in North America.

Cetraria aculeata (Schreb.) Fr.
Islands of Puget Sound, 1906, soil over rocks. Widely distributed over exposed rocks of this region.

Cetraria arctica (Hook.) Tuck.
Near Glacier, British Columbia, 1906, soil over rocks at 9,000 feet.

Cetraria chlorophylla (Humb.) Wain.
Islands of Puget Sound, 1906, dead bark and wood.

Cetraria cucullata (Bell.) Ach.
Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil among rocks.

Cetraria fendleri Tuck.
Socorro County, New Mexico, Coll. C. J. Herrick, 1898, twigs. The type locality is in New Mexico, where collected by Fendler, in 1856.

Cetraria glauca (L.) Ach.
San Juan Island in Puget Sound, near Glacier, British Columbia, 1906, and from National Park, Montana, Coll. M. E. Jones, 1910, trees.

Cetraria juniperina (L.) Ach.
San Juan Island in Puget Sound, 1906, Cascade Mountains, Washington, Coll. T. C. Frye, 1907, and Utah, Coll. L. H. Pammel, 1907, bark and dead wood.

Cetraria madreporiformis (Ach.) Muell.
Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil at high elevations.

Cetraria nivalis (L.) Ach.
Near Laggan, Alberta, 1906, at 8,500 feet. Also Yahulat Island, Alaska, Coll. Trevor Kincaid, 1897, and Albany County, Wyoming, Coll. Aven Nelson, 1901, soil.

Cetraria orbatum (Nyl.).
Islands of Puget Sound, 1906, trees. A little-known lichen described from California as *Platysma orbatum* Nyl.

Cetraria platyphylla Tuck.
Islands of Puget Sound, 1906, trees. Common throughout this area.

Cetraria stenophylla (Tuck.).

Islands of Puget Sound, 1906, trees. Widely distributed in this area.

Cetraria tenuifolia (Retz.) Howe.

At the Palisades on the north shore of Lake Superior in Minnesota, 1897, Isle Royale in Lake Superior, 1902, and near Glacier, British Columbia, 1906, soil.

Cetraria terrestris (Schaer.).

Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil.

Chaenotheca brunneola (Ach.) Muell.

Islands of Puget Sound, 1906, cedar bark. Not well known in North America.

Cladonia apolepta (Ach.)

Islands of Puget Sound, 1906, and Washington County, New York, Coll. S. H. Burnham, 1907, old wood in moist places.

Cladonia bacillaris (Del.) Nyl.

San Juan Island in Puget Sound, 1906, logs.

Cladonia bellidiflora (Ach.) Schaer.

Islands of Puget Sound, and near Glacier, British Columbia, 1906, soil over rocks.

Cladonia carneola Fr.

Islands of Puget Sound, and near Glacier, British Columbia, 1906, soil.

Cladonia cenotea (Ach.) Schaer.

Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil.

Cladonia chlorophaea (Gaud.) Spreng.

Essex County, New York, Coll. Carolyn W. Harris, 1899, and Islands of Puget Sound, 1906, soil.

Cladonia coccifera (L.) Willd.

Islands of Puget Sound, and near Glacier, British Columbia, 1906, soil.

Cladonia cornuta (L.) Schaer.

Near Laggan, Alberta, 1906, soil.

Cladonia crispata (Ach.) Schaer.

San Juan Island in Puget Sound, 1906, soil over rocks.

Cladonia deformis (L.) Hoffm.

Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil and old wood.

Cladonia degenerans (Floerke) Spreng.

San Juan Island in Puget Sound, 1906, soil.

Cladonia denticollis Hoffm.

San Juan Island in Puget Sound, 1906, Cape Breton Island, Coll. G. E. Nichols, 1909, New Brunswick, Coll, G. B. Kaiser, 1910, soil and old wood.

Cladonia digitata (Ach.) Nyl.

San Juan Island in Puget Sound, and near Laggan, Alberta, 1906, soil.

Cladonia ecmocyna (Ach.) Nyl.

Islands of Puget Sound, near Glacier, British Columbia, 1906, Lo Lo Hot Springs, Montana, Coll. M. J. Elrod, and in the Olympic Mountains, Washington, Coll. T. C. Frye, 1907, soil.

Cladonia gracilescens (Floerke) Wain.
Islands of Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, soil.

Cladonia gracilis (L.) Willd.
Islands of Puget Sound, 1906, soil over rocks.

Cladonia leporina Fr.
Hot Springs, Arkansas, Coll. Colton Russell, 1899, rocks.

Cladonia macilenta Hoffm.
San Juan Island in Puget Sound, 1906, old board fence.

Cladonia palamaea (Ach.).
San Juan Island in Puget Sound, 1906, soil over rocks.

Cladonia pityrea (Floerke) Wain.
Fayette County, Iowa, 1896, old wood.

Cladonia pyxidata (L.) Hoffm.
St. Louis County, Missouri, Coll. Colton Russell, 1897, and Lincoln County, New Mexico, Coll. S. F. Earle, 1910, soil.

Cladonia squamosa (Scop.) Hoffm.
Islands of Puget Sound, 1906, old wood.

Cladonia subcariosa Nyl.
Tacoma Park, D. C., Coll. Mabel E. Williams, and Lookout Mountain, Tennessee, Coll. W. W. Calkins, rocks. Distributed as *Cladonia symphycarpa* Fr. in Lichenes Boreali-Americani no. 178, and in W. W. Calkins' North American Lichens, nos. 85 and 94.

Cladonia subulata (L.).
Islands of Puget Sound, 1906, old logs.

Cladonia subsquamosa (Nyl.) Wain.
Islands of Puget Sound, 1906, Chechalis County, Washington, Coll. J. C. Tillman, 1907, and Mt. Hood, Oregon, Coll. T. C. Frye, 1907, soil and old wood.

Cladonia sylvatica (L.) Rabenh.
Islands of Puget Sound, 1906, soil over rocks.

Collema plicatile Ach.
Islands of Puget Sound, 1906, shaded limestone.

Coniocybe furfuracea (L.) Koerb.
Islands of Puget Sound, and Laggan, Alberta, 1906, bark.

Coniocybe pallida (Pers.) Fr.
Waldron Island in Puget Sound, 1906, oak bark.

Dermatocarpon arboreum (Fr.) Fink.
St. Louis County, Missouri, Coll. Colton Russell, 1897, bark.

Dermatocarpon fluviatile DC.
Brown Island in Puget Sound, and near Glacier, British Columbia, 1906, Wet rocks.

Dermatocarpon hepaticum (Ach.) Th. Fr.
Wayne County, Missouri, Coll. Colton Russell, 1898, soil.

Everina furfuracea (L.) Mann.
Rincon Mountains, Arizona, Coll. J. C. Blumer, 1909, dead pines.

Everina vulpina (L.) Ach.
Waldron Island in Puget Sound, and near Laggan, Alberta, 1906, bark.

Gyrophora angulata (Tuck.) Herre.
Grand Marais, Minnesota, 1901, Islands of Puget Sound, and near Glacier, British Columbia, 1906, and Olympic Mountains, Washington, Coll. T. C. Frye, 1907, rocks.

Gyrophora cylindrica (L.) Ach.
Near Glacier, British Columbia, at 9,500 feet, and Laggan, Alberta, at 5,400 feet, 1906, rocks.

Gyrophora deusta (L.) Borr. & Turn.
In several localities on islands in The Lake of the Woods and along the northern boundary of Minnesota, 1899 to 1902, rocks. The plants are sterile and were not determined until recently. Tuckerman included this species with *Gyrophora proboscidea* (L.) Ach.

Gyrophora hyperborea Ach.
Top of Mt. Constitution in Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, rocks at 2,000 to 8,500 feet.

Gyrophora phaea (Tuck.) Herre.
Stewart Island in Puget Sound, 1906, rocks.

Gyrophora polyphylla (L.) Fr.
Islands of Puget Sound, 1906, rocks.

Gyrophora rugifera (Nyl.) Th. Fr.
Beaver Creek, Colorado, 11,900 feet, Coll. L. H. Pammel, 1895, Olympic Mountains, Washington, 8,500 feet, Coll. T. C. Frye, 1907, and San Francisco Peaks, Arizona, Coll. H. C. Cowles, rocks.

Gyrophora vellea (L.) Ach.
Golden Colorado, Coll. L. H. Pammel, 1895, Lo Lo Hot Springs, Montana, Coll. M. J. Elrod, 1897, and Clear Water, Idaho, Coll. L. H. Pammel, 190, rocks.

Heppia despreauxii (Mont.) Tuck.
Jefferson County, Missouri, Coll. Colton Russell, 1898, and Colorado City, Colorado, Coll. H. L. Shantz, 1904, soil.

Icmadophila aeruginosa (Scop.) Mass.
Islands of Puget Sound, and near Glacier, British Columbia, and Laggan, Alberta, 1906, old logs and stumps.

Lecanora albescens (Hoffm.) Th. Fr.
San Juan Island in Puget Sound, 1906, old boards. Previously unknown in North America, unless the same as *Lecanora hageni* (Ach.) Koerb.

Lecanora atra (Huds.) Ach.
Iron County, Missouri, Coll. Colton Russell, 1900, rocks.

Lecanora boligera (Norm.) Hedl.
Near Glacier, British Columbia, Coll. Carolyn Crosby, 1901, bark. Not previously reported from North America.

Lecanora cinerea (L.) Summerf.
Islands of Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, rocks.

Lecanora cinereorufescens (Ach.) Fr.
Near Glacier, British Columbia, 1906, rocks at 6,000 feet. Little known in North America.

Lecanora diffracta (Ach.)
Islands of Puget Sound, 1906, rocks.

Lecanora frustulosa (Dicks.) Ach.
Brown Island in Puget Sound, 1906, rocks.

Lecanora heteromorpha Ach.
Near Glacier, British Columbia, 1906, rocks.

Lecanora hypnorum (Wulf.).
Near Glacier, British Columbia, 1906, mosses.

Lecanora Pacifica Tuck.
San Juan Island in Puget Sound, 1906, wood and bark.

Lecanora pallescens (L.) Schaer.
Missoula, Montana, Coll. M. J. Elrod, 1899, San Juan Island in Puget Sound, 1906, and Olympic Mountains, Washington, and Mt. Hood, Oregon, Coll. T. C. Frye, 1907, bark and mosses.

Lecanora pallida (Schreb.) Schaer.
San Juan Island in Puget Sound, 1906, bark.

Lecanora rabenhorstii (Hepp).
Fayette County, Iowa, 1897, limestone.

Lecanora rubina (Lam. & DC.) Ach.
Iron County, Missouri, Coll. Colton Russell, 1898, rocks.

Lecanora sordida (Pers.) Th. Fr.
Islands of Puget Sound, and near Glacier, British Columbia, 1906, rocks.

Lecanora subattingens (Wain.).
San Juan Island in Puget Sound, 1906, board fences. Not previously reported from North America.

Lecanora tartarea (L.) Ach.
Iron County, Missouri, Colton Russell, 1900, and Islands of Puget Sound, 1906, bark and rocks.

Lecanora ventosa (L.) Ach.
Near Glacier, British Columbia, and Laggan, Alberta, 1906, and Olympic Mountains, Washington, Coll. T. C. Frye, 1907, rocks.

Lecanora verrucosa (Ach.) Laur.
Near Glacier, British Columbia, 1906, soil and mosses.

Lecidea atrobrunnea (DC.) Schaer.
Beaver Creek and LaMotte Peak, Colorado, Coll. L. H. Pammel, 1896 and 1900, Pikes Peak, Colorado, Coll. E. T. Harper, and near Glacier, British Columbia, 1906, rocks.

Lecidea caeruleonigricans (Lightf.) Schaer.
Isla Ryale, Michigan, 1902, rocks.

Lecidea confluens (Ach.) Nyl.
Near Glacier, British Columbia, 1906, rocks.

Lecidea cinnabarina Sommerf.
Islands of Puget Sound, 1906, boards. Known from only a few North American areas.

Lecidea fossarum Duf.
Sulphur Springs, Colorado, Coll. E. Bether, 1913, soil. An inconspicuous lichen, the distribution of which is not well known.

Lecidea fuscoatrata Nyl.
Islands of Puget Sound, 1906, rocks. Previously known only from the type locality in California.

Lecidea fuscorubens Nyl.

San Juan Island in Puget Sound, 1906, rocks. Not previously reported from North America.

Lecidea goniophila (Floerke) Koerb.

West Lake Fork, Utah, Coll. L. H. Pammel, 1900, and Waldron Island in Puget Sound, 1906, rocks.

Lecidea granulosa (Hoffm.) Ach.

Near Glacier, British Columbia, 1906, soil.

Lecidea latypea Ach.

Islands of Puget Sound, 1906, rocks.

Lecidea lutescens (Hellb.) Stiz.

Plummers Island, Maryland, 1907, rocks. Not previously reported from North America.

Lecidea morio Schaer.

Utah, Coll. L. H. Pammel, 1907, rocks.

Lecidea parvifolia Pers.

Butler County, Missouri, Coll. Colton Russell, 1898, bark.

Lecidea platycarpa Ach.

Waldron Island in Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, rocks.

Lecidea pringlei Tuck.

Near Laggan, Alberta, 1906, rocks at 9,000 feet.

Lecidea quernea (Dicks.) Ach.

Brown Island in Puget Sound, 1906, dead wood.

Leptogium albociliatum Desf.

Stewart Island in Puget Sound, 1906, soil.

Leptogium lecerum (Retz.) S. F. Gray.

Waldron Island in Puget Sound, 1906, bark.

Leptogium muscicola (Sw.) Fr.

Islands of Puget Sound, 1906, mosses.

Leptogium myochroum (Schrad.) Tuck.

Islands of Puget Sound, 1906, rocks and bark.

Leptogium palmatum (Huds.) Mont.

Islands of Puget Sound, 1906, mossy rocks.

Lopadium fuscoluteum (Dicks.) Mudd.

Longmire Springs, Washington, Coll. E. T. Harper, 1906, bark.

Lopadium phyllocharis (Mont.).

Gainesville, Florida, Coll. F. M. O'Byrne, 1912, leaves.

Megalospora sanguinaria (L.) Koerb.

Islands of Puget Sound, and near Glacier, British Columbia, 1906, bark.

Micarea denigrata (Fr.) Hellb.

San Juan Island in Puget Sound, 1906, bark.

Nephroma arctica (L.) Fr.

Near Glacier, British Columbia, and Laggan, Alberta, 1906, soil.

Nephroma laevigata Ach.

Near Glacier, British Columbia, 1906, rocks.

Nephroma lusitanica Schaer.

Islands of Puget Sound, 1906, rocks.

Nesolechia punctum Mass.

Fayette County, Iowa, 1902, on *Cladonia mitrula* Tuck.

Pannaria brunnea (Sw.) Mass.

Islands of Puget Sound, and near Glacier, British Columbia, 1906, soil and mosses.

Pannaria hypnorum (Hoffm.) Koerb.

St. Paul's Island, Alaska, Coll. Trevor Kincaid, 1897, and Paradise Valley, Washington, Coll. E. T. Harper, 1906, mosses and soil.

Pannaria lepidiota (Sommerf.) Th. Fr.

Mt. Hesperus, Southern Colorado, 11,000 feet, Coll. Baker, Earle, and Tracy, 1898, Islands of Puget Sound, 1906, and Longmire Springs, Washington, Coll. E. T. Harper, 1906, rocks and bark.

Pannaria leucosticta Tuck.

Madison and Iron counties, Missouri, Coll. Colton Russell, 1898, rocks.

Pannaria microphylla (Sw.) Mass.

Iron and Waine counties, Missouri, Coll. Colton Russell, 1898, rocks.

Parmelia albescens (Schaer.).

Near Glacier, British Columbia, and Laggan; Alberta, 1906, decorticate wood.

Parmelia alpicola Th. Fr.

Near Laggan, Alberta, 1906, rocks at 9,000 feet.

Parmelia ambigua (Wulf.) Ach.

Islands of Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, decorticate wood.

Parmelia centrifuga (L.) Ach.

Near Glacier, British Columbia, 1906, rocks.

Parmelia lanata (L.) Wallr.

Uintah Mountains, Utah, at 12,000 feet, Coll. L. H. Pammel, 1901, and near Laggan, Alberta, 1906, rocks at 9,200 feet.

Parmelia molliuscula Ach.

Laramie County, Colorado, Coll. Mrs. C. F. Baker, 1895, Laramie, Wyoming, Coll. Aven Nelson, 1895, South Dakota, Coll. W. P. Carr, 1902, and North Dakota, Coll. L. R. Waldron, 1904, soil.

Parmelia omphalodes (L.) Ach.

Islands of Puget Sound, 1906, rocks.

Parmelia physodes (L.) Ach.

Islands of Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, bark. Forms of this variable species are common in these areas.

Parmelia stygia (L.) Ach.

St. George Island, Alaska, Coll. Trevor Kincaid, 1897, Wasp Island in Puget Sound, and near Laggan, Alberta, 1906, rocks.

Peltigera venosa (L.) Hoffm.

Near Laggan, Alberta, 1906, soil.

Pertusaria multipuncta (Turn.) Nyl.

Islands of Puget Sound, 1906, bark.

Physcia aipolia (Ach.) Nyl.

Brown Island in Puget Sound, 1906, rocks.

Physcia comosa (Eschw.) Nyl.
Near Little Rock, Arkansas, Coll. Colton Russell, 1899, bark.

Physcia hispida (Schreb.) Tuck.
San Juan Island in Puget Sound, 1906, old fences.

Physcia pulverulenta (Schreb.) Nyl.
Waldron Island in Puget Sound, and near Glacier, British Columbia, 1906, rocks.

Physcia teretiuscula (Nyl.).
Gunflint, Minnesota, 1897, Hot Springs, Arkansas, Coll. Colton Russell, 1899, and Iron County, Missouri, by the same collector, 1900, rocks. Little known in North America, being usually confused with *Physcia caesia* (Hoffm.) Nyl.

Piloporus acicularis (Ach.) Th. Fr.
San Juan Island in Puget Sound, 1906, rocks.

Piloporus hallii (Tuck.).
Longmire Springs, Washington, Coll. E. T. Harper, 1906, and Olympic Mountains, Washington, Coll. T. C. Frye, 1907, rocks.

Placodium aurantiacum (Lightf.) Naeg. & Hepp.
Islands of Puget Sound, 1906, rocks and wood.

Placodium cinnabarinum (Ach.) Anzi.
Islands of Puget Sound, 1906, exposed rocks.

Placodium citrinum (Hoffm.) Leight.
Jefferson County, Missouri, Coll. Colton Russell, 1899, shaded limestone.

Placodium ferrugineum (Huds.) Hepp.
Brown Island in Puget Sound, 1906, bark.

Placodium galactophyllum Tuck.
Washington County, Missouri, Coll. Colton Russell, 1900, exposed limestone.

Placodium jungermanniae (Wahl.) Tuck.
Near Laggan, Alberta, at 7,000 to 9,000 feet, 1906, among mosses.

Placodium lobulatum (Sommerf.) Fink.
Waldron Island in Puget Sound, 1906, rocks.

Placodium murorum (Hoffm.) Ach.
Waldron Island in Puget Sound, 1906, rocks.

Placodium sideritis (Tuck.).
Waldron Island in Puget Sound, 1906, rocks.

Placodium sinapispermum (Auct.) Hepp.
Near Laggan, Alberta, 1906, rocks. Little known in North America.

Placodium ulmorum Fink.
Near LaCrosse, Wisconsin, Coll. L. H. Pammel, 1892, and Rooks County, Kansas, Coll. E. Bartholemew, 1893, bark.

Placodium vitellinum (Hoffm.) Hepp.
Waldron Island in Puget Sound, and near Laggan, Alberta, 1906, soil and rocks.

Psora crenata (Tayl.).
Laramie County, Colorado, at 7,000 feet, Coll. Mrs. C. F. Baker, 1895, soil.

Psora globifera (Ach.).
Isle Royale, Michigan, 1902, and near Glacier, British Columbia, 1906, rocks.

Psora icterica (Mont.) Fink.
Lincoln County, New Mexico, Comm. W. R. Maxon, 1902, and Gillispie County, Texas, Coll. G. Jermy, without date, soil.

Psora lurida (Sw.) Koerb.
Isle Royale, Michigan, Coll. E. T. Harper, 1904, soil.

Pyrenula cerasi (Schrad.) Hepp.
Plummers Island, Maryland, 1907, bark.

Rhizocarpon alboatrum (Hoffm.) Th. Fr.
Waldron Island in Puget Sound, 1906, bark.

Rhizocarpon alpicolum (Wahl.).
St. Paul's Island, Alaska, Coll. Trevor Kincaid, 1897, and near Laggan, Alberta, 1906, rocks.

Rhizocarpon badioatrum (Floerke) Th. Fr.
Near Glacier, British Columbia, 1906, rocks.

Rhizocarpon geographicum (L.) Lam. & DC.
Islands of Puget Sound, near Glacier, British Columbia, and near Laggan, Alberta, 1906, rocks.

Rhizocarpon oidaleum (Tuck.).
Islands of Puget Sound, 1906, and National Park, Montana, Coll. M. E. Jones, 1910, bark, wood, and rocks.

Rhizocarpon petraeum (Wulf.) Koerb.
Islands of Puget Sound, and near Glacier, British Columbia, 1906, rocks.

Rinodina aterrima (Krempelh.) Anzi.
Near Laggan, Alberta, at 9,000 feet, 1906, rocks. A little-known plant.

Rinodina biatorina Koerb.
Plummers Island, Maryland, Coll. W. R. Maxon, 1902, and Bruce Fink, 1907, rocks.

Rinodina constans (Nyl.) Tuck.
Near Shushan, New York, Coll. Frank Dobbin, 1907, trees.

Rinodina hallii Tuck.
Islands of Puget Sound, 1906, bark.

Solorina crocea (L.) Ach.
Montana, Coll. M. E. Jones, 1902, and near Glacier, British Columbia, 1906, soil.

Speerschneidera euplaca (Tuck.) Trev.
Missouri, Coll. Colton Russell, 1900, rocks.

Sphaerophorus globiferus (L.) DC.
Islands of Puget Sound, 1906, bark.

Staurothele diffractella (Nyl.) Tuck.
Washington County, Missouri, Coll. Colton Russell, 1900, limestone.

Stereocaulon alpinum Laur.
Islands of Puget Sound, 1906, rocks.

Stereocaulon tomentosum Fr.
Islands of Puget Sound, 1906, rocks.

Sticta anthrapsis Ach.
Islands of Puget Sound, 1906, bark and rocks.

Sticta crocata (L.) Ach.
Waldron Island in Puget Sound, 1906, mossy rocks.

Sticta limbata (Turn.) Ach.
San Juan Island in Puget Sound, 1906, rocks near shore. A little-known plant in North America.

Sticta oregana Tuck.
Longmire Springs, Washington, Coll. E. T. Harper, 1906, bark.

Sticta scrobiculata (Scop.) Ach.
Waldron Island in Puget Sound, 1906, exposed sandstone.

Synechoblastus pycnocarpus (Nyl.) Fink.
Iron County, Missouri, Coll. Colton Russell, 1900, bark.

Teloschistes lychneus (Ach.) Tuck.
San Juan Island in Puget Sound, 1906, rocks and wood.

Teloschistes polycarpus (Hoffm.) Tuck.
Colorado, Coll. C. F. Baker, 1898, Utah, Coll. L. H. Pammel, 1901, and San Juan Island in Puget Sound, 1906, bark.

Thamnolia vermicularis (Sw.) Ach.
Top of Mt. Constitution in Puget Sound, at 2,000 feet, and near Laggan, Alberta, at 9,000 feet, 1906, soil and rocks.

Thelotrema lepadinum Ach.
Islands of Puget Sound, 1906, and Olympic Mountains, Washington, Coll. T. C. Frye, 1907, bark.

Urceolaria scruposa (Schreb.) Ach.
Islands of Puget Sound, 1906, rocks.

Usnea barbata Fr.
Islands of Puget Sound, 1906, trees.

Usnea cavernosa Tuck.
Islands of Puget Sound, 1906, trees.

Usnea florida (L.) Ach.
Gillespie County, Texas, Coll. G. Jermy, without date, Madison County, Missouri, Coll. Colton Russell, 1898, and Flathead Lake, Montana, Coll. M. J. Elrod, 1899, trees.

Verrucaria fuscella (Turn.) Ach.
Washington County, Missouri, Coll. Colton Russell, 1900, limestone.

Verrucaria margacea Ach.
Olga Island in Puget Sound, and near Glacier, British Columbia, 1906, rocks.

Verrucaria nigrescens Pers.
San Juan Island in Puget Sound, and near Glacier, British Columbia, 1906, rocks.

MIAMI UNIVERSITY,
OXFORD, OHIO.

A FIELD MEETING OF PATHOLOGISTS

William A. Murrill

(With Plate 15)

The writer was invited to represent the New York Botanical Garden at a meeting of plant pathologists and Connecticut farm bureau agents, held during the week beginning August 18 at New Haven, Storrs, and elsewhere, for the discussion of some of the most important problems now confronting the Connecticut farmers, fruit growers, and truck gardeners. About twenty botanists, mostly from New England and New York, were present; while several hundred other persons were in attendance at special meetings. The evenings were devoted to brief papers and discussions; the mornings and afternoons to automobile tours through the plantations between New Haven, Hartford, and Storrs. A distance of three hundred miles was covered in these tours, during which time the weather was most delightful.

The meeting on Monday evening at the Graduates Club of New Haven, presided over by Dr. E. H. Jenkins, was devoted to a variety of general subjects, such as "Plant Pathology and the College Course," "Closer Relations between France and America," "Entomology and Pathology," "Tropical Forestry," "The Botanical Garden and the Pathologist," and "Reminiscences of Dr. Farlow."

On Tuesday morning, various departments of the Agricultural Experiment Station were visited and then a tour made of orchards and farms showing peach and apple spraying experiments, peach yellows, potato tests, corn breeding experiments, effects of fertilizers on fungi, etc.

In the afternoon, the Yale Botanical Laboratories were inspected under the guidance of Professor Evans and Dr. Whitford; after which the party went on a long journey through the market gardens of Highwood and Westville, the Elm City Nur-

BENEATH THE WETHERSFIELD ELM

Photo by Prof. Morse

sery, and the seed farms of Orange, Milford, and Woodmont. At the nursery, Mr. Coe exhibited many dwarf trees he had brought from Japan, as well as an interesting climbing Hydrangea, excellent for walls, and the original plants and parents of the hybrid box privet, a border shrub of great promise. An hour's stop was made at Savin Rock for dinner, and then the party proceeded to the Assembly Hall of the Experiment Station for the evening meeting.

Dr. Hartley, Director of the Rhode Island Experiment Station, presided at this meeting, the general subject of which was "Tree Diseases." Dr. A. H. Graves spoke on "Resistant Chestnut Trees"; Dr. Florence McCormick on "White Pine Blister Rust"; Professor Butler and Mr. Stoddard on "Spraying Trees"; and Dr. Clinton on "Peach Yellows." Most of these talks were illustrated with lantern slides and some with microscopic mounts. It seems to be established that blister rust infects pine needles through their breathing-pores; and that peach yellows, probably an enzymatic disease, may be transmitted from one tree to another by grafting with bud or bark.

An early start was made Wednesday morning for Storrs, where the Agricultural College and Extension Bureau are located. The first stop was at the Barnes Brothers' apple, pear, and peach orchards, to see a commercial plantation of dwarf McIntosh apples; a dusting machine in operation throwing clouds of dry sulphur in the air; and a peach orchard that had been entirely renewed and probably saved from yellows by proper treatment with sodium nitrate and other fertilizers.

The largest greenhouses in America are located at Cromwell. About 22 acres are under glass, one house being 800 feet long by 82 feet in width and another 500 by 480 feet, the latter entirely filled with roses. Ferns, begonias, palms, carnations, chrysanthemums, etc., are also grown in abundance and under the very best conditions. The establishment was far too large to admit of a thorough examination, so we inspected a few of the larger houses, the storage rooms, and the packing rooms, and then continued our journey toward Hartford.

At Wethersfield, we grouped ourselves beneath the largest elm

in the United States while Professor Morse and Professor Torrey took photographs. This remarkable tree is 30 feet in circumference, 97 feet high, and 250 years old, the branches spreading 75 feet from the trunk in all directions. It stands on the edge of the highway without protection of any kind.

Elms, sugar maples, and plane-trees were the commonest roadside trees in the regions visited, many of them being old and very handsome. A sugar maple was seen at Wapping that measured 17 feet in circumference and 80 feet in height. On account of the wet season, fruit-bodies of large fungi were common on the trunks of various trees, *Fomes populinus* being often observed on sugar maples and *Spongipellis galactinus* on apple trees. Both of these polypores are white and visible at long distances. Many examples of bad tree doctoring were in evidence along the principal highways.

Lunch was taken in Hartford near the Morgan Memorial, after which we left at top speed for Storrs, finely located among the hills with a broad view of the surrounding mountains and valleys. The only dining-room in the place has a reputation for closing very promptly, hence our haste. All of the remaining daylight was utilized in inspecting the potato fields, orchards, greenhouses, dahlia garden, and botanical garden, under the guidance of Professors Slate, Hollister, Fraser, and Sinnott.

The evening session was devoted to a historical sketch of tobacco growing in Connecticut, by Dr. Jenkins, and a discussion of potato, tobacco, and market garden diseases by Messrs. Morse, Chapman, and others. Dr. Olive also discussed the relation of the botanical garden to the public.

Thursday was a very important field day, devoted chiefly to tobacco. Leaving Storrs shortly before nine, the first stop was made at East Windsor Hill to see the fields of broad leaf tobacco in that vicinity and the Haviland plantation of tent Cuban tobacco, with narrow leaves.

Considerable "rust," or "burn," was found on tobacco grown in the open. Many of the upper leaves were scalded like maple leaves on a hot day after a spell of rainy weather. Some showed small brown spots and others white spots, the latter resembling

insect work. All of these injuries may possibly have been due to the "mosaic," or "calico," disease, which renders the leaf thin and sickly, and unable to resist sudden changes in atmospheric conditions. Many plants showed yellow lower leaves, doubtless due to lack of potash or other fertilizer trouble.

Tobacco mosaic, like potato mosaic and peach yellows, is a very widespread and mysterious disease. It may be carried far and wide through the field by simply touching the leaves with infected hands. In old plants, if the lower leaves are touched, they will not take the disease, but will communicate it to the younger leaves and suckers at the top. The danger to the crop comes in handling the seedlings, which if infected develop into weaker plants of less value. When the crop is far advanced, there is little need for caution, since the sources of infection are always destroyed during the winter.

On Thursday afternoon, after an excellent lunch at Thompsonville, the Havana tobacco district at Suffield was visited and an inspection made of various experiments in progress there under the direction of Mr. Clayton. Johnson's susceptible burly, grown for comparison, was found to be badly affected with *Thielavia* root-rot, which turns the tips of the roots brown or black, while in *Fusarium* root-rot the lesions are lighter in color. These rots are readily seen after the roots have been rinsed in water.

The last stop of the day was made at the extensive tented fields of the American Sumatra Tobacco Company, where 290 acres are under cloth costing a million dollars, and 67 acres are covered by a single tent. The yield this year is enormous, probably because of the plentiful rains. After several bad years, a number of growers in the district had turned their fields out to rest or were cultivating them in corn, timothy, and other crops for a change, which seemed unfortunate in view of the present tobacco yield.

This company is transporting men, women, and children by the hundreds in motor trucks from Hartford to harvest the crop. The lower leaves are taken off, four or six at a time, as they ripen and hauled in covered baskets to the barns, where they are strung on cords fastened to sticks and hoisted into the barns to dry. In

damp weather and at critical periods a little charcoal is used. When winter comes, the tobacco is sweated, sorted, graded by experts, and packed for shipment. It brings over a dollar a pound.

The tobacco growing district of Connecticut is limited to the valley of the Connecticut River and other localities at least twenty miles from the ocean where the soil is light and rich in organic matter. A great deal of fertilizer is necessary. The seed-beds must be sterilized with great care and the best seed used. After a certain number of crops, the land must be rested and renewed by growing other crops upon it.

On Thursday evening Dr. Olive, Professor Sinnott, and the writer were the guests of Dr. Clinton, who planned the meetings and did so much to make them a success. The following list of botanists in attendance was furnished by him.

Prof. A. W. Evans and Dr. H. N. Whitford, of Yale, and Dr. A. H. Graves, formerly of Yale.

Dr. E. W. Olive, of the Brooklyn Botanic Garden.

Professors E. W. Sinnott and G. S. Torrey, of Storrs.

Professors A. V. Osmun and W. S. Krout, and Dr. G. H. Chapman, of the Amherst Agricultural College.

Prof. W. J. Morse, of the Maine Experiment Station.

Prof. O. R. Butler, of the New Hampshire Experiment Station.

Prof. M. F. Barrus, of the Cornell Experiment Station.

Dr. W. A. Murrill, of the New York Botanical Garden.

Dr. G. R. Lyman, of the Disease Survey, B. A. Porter, of the Entomological Division, and E. E. Clayton, of the Tobacco Work, of the U. S. Dept. of Agriculture.

Dr. Grace Clapp, of Smith College.

Dr. Florence A. McCormick, E. M. Stoddard, and G. P. Clinton, of the Connecticut Experiment Station.

NEW YORK BOTANICAL GARDEN.

NOTES AND BRIEF ARTICLES

[Unsigned notes are by the editor]

Owing to the increased cost of publication, the price of MYCOLOGIA *will be advanced to four dollars ($4.00) at the beginning of 1920. This price will also apply to back volumes; which can still be supplied in complete sets.*

Professor L. R. Hesler, formerly of the Department of Plant Pathology of Cornell University, is now head of the Department of Botany of the University of Tennessee, a position recently made vacant by the death of Professor S. M. Bain.

Mr. C. G. Lloyd, of Cincinnati, Ohio, spent the last week in August and the first two weeks in September at the Garden studying and photographing types of *Xylaria* and the larger species of *Hypoxylon* in the Ellis Collection, which contains numerous type specimens of North American Pyrenomycetes.

Mr. H. B. Weiss, of New Brunswick, New Jersey, is making a study of the beetles and other insects that infest fungi, and finds that the species that feed on woody fungi are usually different from those infesting mushrooms. He would be glad to receive specimens when accompanied by the correct name of the host.

Dr. W. C. Coker was actively engaged during the past summer in completing his investigation of the genus *Clavaria*. Besides devoting considerable time to library and herbarium study at the Garden and other institutions, he was able to spend several weeks in collecting at various localities in the eastern United States, from North Carolina to New England, where conditions were suitable for the development of the coral-fungi. His series of illustrations of this interesting group of fungi is excellent.

It was stated in the September number of MYCOLOGIA that Dr. C. T. Gregory had accepted a position in Norfolk, Virginia. Dr. H. S. Jackson asks me to correct this erroneous statement and to say that Dr. Gregory was retained after July 1 as extension pathologist of the Indiana Agricultural Experiment Station, having immediate charge of extension work in vegetable and truck crop diseases. He did consider a position in Virginia, but finally decided not to accept it.

The *American Journal of Botany* for July, 1919, contains a list of the publications of the late Prof. Atkinson prepared by Dr. H. M. Fitzpatrick, of Cornell University. It covers five and a half pages printed in small type. A brief sketch of his life appears in the same number. Another account appeared in the *Botanical Gazette,* contributed by Prof. Whetzel, of Cornell. The best recent photograph of Prof. Atkinson is probably the one published by Mr. Lloyd in his *Mycological Notes* for June, 1919.

Two valuable circulars were recently issued by Dr. Mel. T. Cook, of the New Jersey Experiment Station. One deals with the common diseases of herbaceous plants used as ornamentals, and the other with the diseases of shade and ornamental trees. They are both well illustrated, and contain directions for treatment in all cases. The subject of ornamentals is too often overlooked by the plant pathologist, who usually has more than he can do in attending to the wants of diseased economic plants. Here is a chance for the establishment of a fellowship for an extended investigation of the diseases of ornamental plants.

In a report on white pine blister rust control for 1918, Dr. G. P. Clinton and his associate, Dr. Florence McCormick, of the Connecticut Agricultural Experiment Station, describe a method of making artificial infections of detached leaves in Petri dishes, where they may be kept alive for weeks and closely watched, while the amount of moisture and light may be readily controlled. Leaves of trees and shrubs may be handled in this way, but herbaceous leaves are apt to wilt. In the same report, it is stated

that the blister rust enters pine trees through the stomates on their leaves, producing at first characteristic golden-yellow spots or bands.

The first specimen of *Grifola Berkeleyi* I have seen from Alabama was sent in last July by Mr. J. E. Fries, of Birmingham. This very large polypore occurs at the base of oak trees and is evidently parasitic on oak roots. It has received several names, such as *P. anax, P. lactifluus,* and *P. subgiganteus,* all of which are characteristic; but the earliest name, *P. Berkeleyi,* was assigned by Fries in 1851 to a fragment sent to him by Berkeley, who received it from Curtis in North Carolina. While in Virginia last summer, I saw an immense specimen of this fungus growing against the base of an oak on the college campus at Blacksburg, which measured fully two feet across.

A bulletin has recently been published by the U. S. Department of Agriculture treating of the rosette disease of pecan trees in the southern states. After considerable experimenting, it has been discovered that this serious disease is caused by soils deficient in humus, fertility, and moisture supply. In setting new orchards the bulletin recommends that only good land be used. Deep sand, clays underlaid with sand, and eroded hillsides should be avoided. After the orchard is planted the cultural practices should be such as to increase the depth, humus content, fertility, and moisture-holding capacity of the surface soil as rapidly as possible, and to conserve moisture during dry periods. Intercropping with shallow-rooted plants and legumes is a good practice.

Mrs. John R. Delafield collected a number of interesting fungi at Buck Hill Falls, Pennsylvania, in August and presented them to the Garden herbarium. Notes and colored drawings accompanied several of the specimens which were of particular value. The very rare *Tyromyces balsameus,* the dainty little *Prunulus cyaneobasis,* and the brilliantly-colored *Melanoleuca Russula* were among the number. Also: *Chanterel minor, C. cinnabari-*

nus, C. Chantarellus, C. infundibuliformis, Hydrocybe conica, Melanoleuca albissima, Clitocybe clavipes, Gymnopus carnosus, Lactaria torminosa, Cortinarius alboviolaceus, Tyromyces lacteus, Tremellodon gelatinosum, Hydnum velutinum, Helvella crispa, Macropodia fusicarpa, Aleuria aurantia, Otidea grandis, and many other species.

An old English walnut tree in Lynchburg, Virginia, was referred to in the last number MYCOLOGIA as having borne diseased fruits since about 1915. This walnut blight, *Bacterium juglandis,* has been known since 1900 on the Pacific coast, where it is considered a most serious disease and one not amenable to treatment. In 1913, it was reported in New York and New Jersey, and in 1916 it was found quite generally distributed in the eastern United States. During the latter year, it was observed that infection took place about the last of May, but the disease did not penetrate deeply into the tissues of the nuts until the middle of August. In California, infection occurs about flowering time and is serious if the weather is moist. The only hope of controlling this bacterial blight lies in the discovery of immune or resistant varieties.

The oldest Japanese chestnut tree on our grounds, one that has survived since the early days of the Garden, persisting through the terrible epidemic of canker which killed off all the other chestnuts, failed to put forth its leaves last spring. It is dead—killed by an attack of the canker that was almost imperceptible at first but finally proved too strong for it. This tree has been carefully observed for fourteen years, or since the canker was discovered in this vicinity. The disease gained entrance several years ago through a small branch three feet above the ground and worked away at the base of the trunk until it was completely girdled. Only one small canker was found in the top of the tree, which had a spread of twenty feet or more and remained green through the season of 1918.

Leaf-blight of the plane-tree and white oak has been unusually prevalent this season, owing to the wet weather in May. This

disease, which renders the trees so unsightly, may be controlled by sanitation, pruning, and spraying, but the process is expensive and exacting. Spraying alone will be of value if done at the proper time. Use the strongest Bordeaux mixture (5–5–50), applying it thoroughly with a power sprayer before the leaves are half grown, and repeat two or three times at intervals of a week or ten days according to the weather. This solution kills the summer spores and prevents infection of the new leaves. If the dead twigs and leaves, both on the trees and on the ground, are collected and burned, the winter spores will be killed and the disease will not appear with the opening of the buds. All the trees in a given locality should be treated at once.

In an article on the growth of wood-destroying fungi on liquid media contributed to the *Annals of the Missouri Botanical Garden* for April, 1919, by Zeller, Schmitz, and Duggar, the following conclusions are drawn:

1. Many wood-destroying fungi are not suitable for growth experiments with liquid media.

2. With respect to the media employed and to the species studied, *Merulius pinastri, Polyporus lucidus, Polystictus versicolor, Pleurotus sapidus,* and *Trametes Peckii* grow best in the order named. Others grow well only on certain media, *e. g., Lenzites vialis, Daedalea quercina,* and *Merulius lacrymans* on Richards' solution.

3. Czapek's solution with the monobasic, and Richards' solution with the mono-, di-, and tribasic potassium phosphate proved generally to be suitable media. Thus, there is a decided indication of the desirability of selecting a specific medium for each fungus.

Dr. Robert T. Morris has been collecting fleshy fungi on his country place at Stamford, Connecticut, and sending them to the herbarium of the Garden. He recently sent in a very peculiar gray form of *Venenarius solitarius,* and specimens of the rare *Melanoleuca pallida* and *Lactaria atroviridis.* He writes as follows: "I ate a good-sized piece of the *Lactaria atroviridis* and found it fairly tender, sweet, and good, with no bad effects fol-

lowing. The large colony of this species passed away before I could get your answer about edibility. I also tried a mess of *Melanoleuca pallida* and found it to be a first-rate mushroom, not in the very best class, but merely excellent." Speaking of the relation of fire to fungi, he writes: "About one hundred acres of my country place were burned over two years ago in early May, leaving several hundred chestnut stumps in the burned area. Last year *Fistulina hepatica* was more abundant on the burned stumps than on the others. This year it is very abundant on the burned stumps—sometimes three or four specimens to the stump."

DR. WILLIAM GILSON FARLOW

Dr. Farlow died at his home in Cambridge, Massachusetts, on June 3, 1919. He was born in Boston in 1844 and graduated at Harvard in 1866. He afterwards studied botany in Europe for several years, chiefly with Professor de Bary. In 1874, he became a member of the Harvard faculty, and three years later was appointed professor of cryptogamic botany, which position he held for a period of forty years.

He was a pioneer in cryptogamic botany in America, and wielded an influence through his teaching, his publications, his library, his herbarium, and his instructive and stimulating correspondence, that has scarcely been equaled. Honors were showered upon him from all parts of America and Europe, and no one more richly deserved them. The funeral services were held in Appleton Chapel and he was buried in Newton Cemetery.

All of his large collection of books and manuscripts was left to Harvard University, to constitute the Farlow Reference Library. The sum of $25,000 was left in trust to his assistant, Mr. A. B. Seymour, who will enjoy its income during his life. On his death this fund will be added to a gift of $100,000 previously made to Harvard and known as the John S. Farlow Memorial Fund. On the death of Professor Farlow's widow, $100,000 will be given to the University and added to the same fund.

W. A. MURRILL

A POLYPORE PARASITIC ON TWIGS OF ASIMINA

This species, *Inonotus amplectens,* was first described by the writer (Bull. Torrey Club 31:600. 1904) from specimens collected by R. M. Harper on the Ocmulgee River near Lumber City, Georgia, in September, 1903. The fruit-bodies were found encircling living twigs of *Asimina parviflora.*

There are now four other specimens in the herbarium of the New York Botanical Garden. A collection was made on *A. parviflora* at Rock Springs, Orange Co., Florida, on August 28, 1909, by Mr. C. H. Baker, who stated that it was first observed by him about 1904.

Two collections were made by Mr. Baker on *A. pygmaea* in August, 1909; one near McDonald and the other near Plymouth, in Orange Co., Florida. He says that the fungus is peculiar to *Asimina,* and that the twigs on which it grows usually appear to be killed.

When Dr. G. Clyde Fisher was in Florida recently, he collected the same polypore on living twigs of *Asimina angustifolia* at Gainesville, July 29, 1919, thus adding another specimen and another host to our collection.

This interesting fungus is now known from Georgia and northern Florida, occurring on three species of *Asimina: A. parviflora, A. pygmaea,* and *A. angustifolia.*

W. A. MURRILL

AN ORANGE-COLORED PUFFBALL

Calvatia rubroflava has been collected two past seasons in the dahlia bed near the museum building of the Garden, but well-developed specimens were not obtained until brought in by Miss Eaton on August 22, evidently having grown from the same patch of mycelium. This puffball, which is easily recognized by its orange color, is very rare, although widely distributed in gardens and other cultivated places. The species was first described by Cragin in the *Washburn College Bulletin* for 1885, from specimens collected in Kansas in October. The measurements given in his description, which is copied below, are rather small, my plant being 3½ inches broad and nearly three inches high.

"*Lycoperdon rubro-flavum* sp. nov. Small, from less than an inch to an inch and a half and nearly as broad, obconic, tapering gradually downward to the rooting origin, rather than contracted into a stem-like base. Peridium thin, vanishing irregularly above, where it is orange-red to orange-brown in color, evenly rounded, and farinaceous, with scattered, low, conical spines and granules, which become blackish from greyish white; below brownish pink, naked, shining, and irregularly shrunken-rugose. Capillitium and spores olivaceous orange, the external portion having the orange tint deeper and becoming bright orange-red when exposed by the secession of the peridium. Spores subglobose, with a depression on one side, mostly non-pedicellate, smooth, very small, about .003 mm. in diameter."

W. A. MURRILL

A MEETING OF PATHOLOGISTS ON LONG ISLAND

About one hundred plant pathologists, representing many sections of America, as well as England and Holland, met on Long Island, June 24–28, to study potato diseases in the field and to discuss these and other diseases of immediate interest to farmers and horticulturists. The plans were carefully arranged by Dr. M. F. Barrus; the Farm Bureau prepared charts; and many farmers loaned their cars for tours to various sections of the Island.

On Tuesday afternoon, the pathologists met in Riverhead and were welcomed by Mr. Talmage; on Wednesday, they made a tour of the North Side, returning to Riverhead for an evening meeting; on Thursday, the South Side was visited, and a meeting was held at Watermill, with addresses by Dr. Cotton, of England, Dr. Quanjer, of Holland, Dr. Pethybridge, of Ireland, and Dr. Edson, of Washington; on Friday, an inspection trip was made in Nassau County, starting from Mineola; and on Friday evening there was a conference at the McAlpin Hotel in New York City.

A meeting of Northeastern Pathologists, in charge of Prof. C. R. Orton, was held at the Brooklyn Botanic Garden on Saturday, June 28, at which potato leaf-roll, the potato wart disease, apple scab, etc., were discussed and an illustrated lecture given by Dr. Quanjer. There was also a meeting of the advisory board.

The importance of such conferences and field inspection tours cannot be overestimated. The New York Botanical Garden was represented by Dr. Seaver, Dr. Stout, and the writer.

W. A. MURRILL

BOLETI FROM CONNECTICUT

Prof. H. L. Wells, of Yale University, is well known as a chemist, but it is not so generally known that he is an ardent mycologist and mycophagist during the vacation season. He and his daughter Gertrude have sent from the vicinity of Old Lyme, Connecticut, and elsewhere a great many specimens of interesting fleshy fungi. In a letter written at Old Lyme on July 30, he says:

"In a section of the woods here is a remarkable place for boleti, and several I have not identified. I have found *B. felleus* in great abundance, also *B. indecisus,* perhaps equally abundant, which unless very young I cannot distinguish except by tasting or bruising. *B. alveolatus* and *B. bicolor* are also very common; and I have seen *B. illudens, B. scaber, B. ornatipes, B. pallidus, B. gracilis, B. subglabripes, B. punctipes, B. luridus, B. speciosus, Strobilomyces strobilaceus,* and *Boletinus pictus,* curiously rare here. *B. cyanescens* and *B. chromapes* are often common, but have not yet appeared.

"Of course, I have found many other things besides boleti. One of the most interesting was a specimen of *Amanita Caesarea,* which I have not found before in this locality. However, seventeen years ago, I found some small specimens of it at Grove Beach, Conn., and fifteen years ago two magnificent plants near Worcester, Mass.

"I have found also *Boletus Gertrudiae,* which Peck described for me, not very accurately, as the specimens always decayed before he got them, and I think I mixed up two species in my account of it to him. He said it was a very remarkable thing."

Then Prof. Wells sent specimens of *B. illudens, B. chromapes, B. griseus, B. pallidus,* and large collections of *Boletinus castanellus* and *Boletus Gertrudiae.* On July 31, he wrote as follows:

"As I happened to find about a dozen specimens of *Boletus Gertrudiae,* described by Peck about seven or eight years ago, and

not quite correctly through *my own fault,* as you are at liberty to state, I sent you a box of them to-day by parcel post, and if you think this a good species I hope you will describe it anew, as Dr. Peck wrote me he hoped to do, but did not get to it. I give you my description of it on another sheet of paper."

As this group of fungi is very difficult and can be accurately known only through careful studies of fresh specimens, I give Professor Wells' notes on *B. Gertrudiae* almost in full. He is probably the only man who is thoroughly acquainted with this species.

"Pileus nearly flat when rather young, usually becoming nearly hemispheric when older. Color at first light-brownish-yellow, usually brighter yellow toward margin, and becoming bright-yellow at maturity all over, and then often paler in the central part. Glabrous and somewhat moist to the touch, rather bright and shining. Usually 4 to 6 inches in diameter. Flesh always white until decay sets in. Tubes very small, white, and stuffed, then yellow, becoming rusty-yellow with age. Stem pure-white without and within at first, slightly reticulate, then later the top of the stem for about an inch or more becomes bright-yellow and this color extends gradually downward, without and within, as the plant grows older and finally the whole stem may become bright-yellow. The stem is solid, large, and enlarged toward the base."

This species occurs in rather dense frondose woods in many places near Old Lyme in mid-summer. The aspect of the plant is large and stout, resembling *B. edulis.* It was named for Miss Gertrude Wells, who has been an amateur mycologist since she was six years old.

W. A. MURRILL

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Syntherisma pruriens, error in publication.

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INDEX TO VOLUME XI*

New names, and the final members of new combinations, are in **bold face type.**

* It has been considered unnecessary to include here the species listed in the four following articles, since they are already indexed or specially listed.

Anderson: Index to American species of Phyllosticta. See p. 66.

Fink: Additions to lichen distribution in North America. See p. 296.

Murrill: Cuban polypores and agarics. See p. 22.

Overholts: Some Colorado fungi. See p. 245.